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UNITED STATES DEPARTMENT OF AGRICULTURE
· AGRICULTURAL RESEARCH SERVICE

DIFFERENTIATION OF MICROORGANISMS
BY INFRARED SPECTRA

Final Report

prepared for
Biological Department, Army Chemical Corps
Camp Detrick, Frederick, Maryland

under
Contract Nos. CD3-119 and CD4-400

by
Northern Utilization Research Branch
Peoria, Illinois

July 18, 1956

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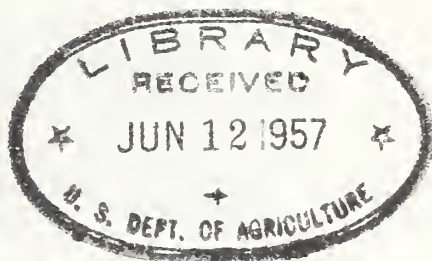
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Final Report
on
DIFFERENTIATION OF MICROORGANISMS BY INFRARED SPECTRA

Submitted by
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SUMMARY:

A total of about 4,000 infrared spectral curves of microorganisms representing 32 genera, 145 species, and 356 strains were obtained. Large differences in spectra were found, but the differences were as large between strains of some species as at any higher taxonomic level. Only one strain (Nocardia rubra NRRL B-685) had a unique spectrum and, therefore, could be uniquely identified. Since this strain was the only representative of its species that was examined, it is not known whether the species has unique spectra. Other species of the genus do not have this spectrum.

The presence of the 5.7 micron and contingent bands, which is the most recognizable difference among bacterial spectra, occurred only in about 5 percent of the total strains. It was not restricted in occurrence to any taxonomic group, there being strains in many genera whose spectra exhibited this feature. In our survey it was found most prevalent among aerobic sporeformers (Bacillus). The only species, all of which strains behaved consistently, was Bacillus cereus. All strains of its varieties (anthracis, mycoides, and thuringiensis) also conformed to the species pattern of strong absorption at 5.7 microns and contingent loci when examined following growth in the presence of glucose or other suitable hexose, alcohol or organic acid in proper concentration. In the absence of such supplementary carbon compounds the 5.7 micron band complex was not detected. Glucose appeared to be the best precursor. The degree of absorption was found dependent upon the concentration of glucose in the growth medium, the optimum level being in the range 1 to 2 percent.

Studies also were conducted on the effect of physiological age. Three physiological types were found to exist among strains of Bacillus megaterium. In one type neither glucose nor any other carbon source tested evoked the 5.7 micron band regardless of the age or stage of growth of the cells used. In a second type, cells grown in media containing glucose produced the substance responsible for the 5.7 micron band absorption and it accumulated in the cells. Spectra derived from cells of this type showed the characteristic 5.7 micron band features even at a chronological age of 7 days. A third type apparently produces the 5.7 micron band substance and accumulates it so that it may be detected at chronological ages up to 18 to 24 hours. However, the substance presumably is then metabolized because absorption at 5.7 microns and contingent bands decreases as the cells age and is no longer evident

in cells aged 48 hours or more. The existence of these types suggests that, insofar as detection of the 5.7 micron band complex is concerned, reliance upon a single standardized chronological age for preparation of films may be unwise. At age 24 hours these three types may be indistinguishable whereas the second type would be readily recognizable in 48-hour or older cells, while the third type would be recognized more certainly at 12 to 18 hours. The first type can be identified by the fact that its spectrum would show insignificant changes with age in the 5.7 micron and subsidiary bands.

Because of its occurrence in the spectra of such a small proportion of the microorganisms surveyed, the 5.7 micron band contour seems of unlikely aid in identification beyond the limits discussed above.

An internal method for obtaining corrected transmission data at maxima and minima in spectral curves was devised. This method has permitted the experimental data to be corrected for variations in film thickness which are difficult to avoid in preparation of samples. The corrected data formed the basis of a statistical study of the infrared curves to determine whether significant differences existed at various taxonomic levels. The statistical calculations showed that "F" values (variance ratios) at all taxonomic levels investigated were generally far above the 1 percent critical values which would result by chance. Therefore, there were real differences in transmission values among different strains, species, and genera.

Frequency distributions of transmission values at selected wavelengths for groups at various taxonomic levels differed greatly, depending mainly on the population of the group. Large groups such as Pseudomonas, for example, showed a nearly continuous distribution of values approximating a Gaussian distribution. Such groups appeared impossible to divide into subgroups which would have value in the infrared identification of bacteria. In contrast, frequency distributions of several smaller groups were discontinuous with breaks along the axis of transmission values which provided a basis for division into subgroups. For example, 20 strains of Bacillus megaterium could be divided into 14 subgroups with no more than 3 strains in any subgroup. It is possible, however, that if a greater number of strains of this species were examined, there would be an overlapping of strains in subgroups and an increased ambiguity in identification.

At the genus level it proved possible to distinguish infrared curves of 119 strains of Pseudomonas from those of 76 strains of Bacillus with about 90 percent success. Samples of other genera, however, were distributed over the same range of transmission values and if present would interfere with the identification of Pseudomonas and Bacillus.

The greatest obstacle to identification was the variability among strains of a species. This variation appeared to be as great as the difference at any taxonomic level.

Further development in the infrared method of identification will depend on multiple sortings and correlations by machine methods. Improvements in sample preparation techniques so that transmission values as read could be used also would be a valuable contribution to the method.

A. INTRODUCTION:

In recent years it has been found possible to identify many organic compounds by means of infrared spectroscopy. Because infrared spectra can be recorded rapidly with modern instruments, Stevenson and Bolduan (Science, 116, 111-113 (1952)) became interested in the applicability of this technique for the characterization and identification of microorganisms. Working with a small number of pathogenic bacteria they concluded that the infrared spectra differentiated genera of a family, species in a genus, and, in some cases, strains of a species. Levine, Stevenson, Chambers, and Kenner (J. Bact., 65, 10-15 (1953)) continued the investigation and believed the method showed special promise for differentiation of enteric bacteria. In England, Norris (Proc. 6th Internat. Congr. Microbiol., 1, 411-412 (1953)) and later, Thomas and Greenstreet (Spectrochimica Acta, 6, 302-319 (1954)) added their opinions that infrared spectroscopy might make rapid identification of bacteria possible. The first dissenting opinion was given in 1954 by Kull and Grimm (Bact. Proc., 26 (1954)). Their work was based on very few strains, however, and their conclusions were not well supported by published data. Workers in allied fields have become interested in the prospects for use of this method. Cawley, Wheeler, Boatwright, Smith, Randall, and Lingamfelter (Jour. Invest. Dermatol., 22, 273-278 (1954)) concluded that infrared spectra of the pathogenic fungi they studied would not enable their positive identification or differentiation. Four groups of viruses were consistently identified by their infrared spectra by Benedict (J. Bact., 69, 264-269 (1955)), but related viruses within each group could not be differentiated. He had difficulty in separating host material from his viruses. His work was exploratory and served mostly to delineate the problems involved.

A few other publications have dealt with special aspects of the problem such as the correlation of virulence of tuberculosis microorganisms with their infrared spectra (Randall, Smith, and Nungester, Amer. Rev. Tubec., 65, 477-480 (1952)) and the relationship between serologic types of pneumococci and their infrared curves (Stevenson and Levine, Science, 116, 705-706 (1952)).

All of the reports cited dealt with selected groups of pathogenic bacteria, but Drs. O. E. A. Boulduan and C. Phillips envisioned greater usefulness for the method. They wondered if it might not be possible to differentiate and identify microorganisms in general, regardless of their pathogenicity or any other restrictive limit. The reputation of the Northern Utilization Research Branch as a repository for a large number and great variety of microorganisms, including yeasts and molds and the availability of infrared equipment, was known to these two men and

they proposed that further studies be undertaken at this Branch. Eventually, a cooperative agreement was reached in which the Northern Branch undertook to determine the applicability of the infrared absorption method as a means for the rapid identification and classification of microorganisms. This objective was pursued for 2-1/2 years and the report following this introduction summarizes our conclusions.

The collection of bacteria at the Northern Branch differs from the collections of Camp Detrick and of the Robert A. Taft Sanitary Engineering Center in that it comprises primarily microorganisms of agricultural and industrial importance and related types. Thus, there are few human and animal pathogens. We were consequently able to investigate genera not likely to be well represented in the collections of the other collaborators.

It was realized that it would be advisable to encompass many genera in our study going deeply enough into each to determine the efficacy of the infrared technique in distinguishing its component species. This would automatically lead to evaluation of the usefulness also in differentiating between genera and higher taxa. It soon became apparent, however, that we would be restricted in our choice by circumstances beyond our control. Insufficient growth to allow preparation of a sample was one restrictive factor. This was sometimes due to unsuitability of the standard medium and conditions for optimum growth of some microorganisms, but in many cases was because of inherent inability to grow luxuriantly. This eliminated such groups as the lactic acid bacteria, acetic acid bacteria, and the anaerobic sporeformers. Members of the genus Streptomyces, though producing apparently abundant growth, adhered to the medium and only scanty amounts of spores could be scraped up. Among these groups were a large proportion of the genera originally looked upon as likely taxa for survey.

Because of these hindrances we first selected a genus for investigation. Later, this was expanded to two genera. No difficulty was experienced in selecting these two because the collection at the Northern Branch was especially well stocked with variable numbers of many species of aerobic sporeformers (Bacillus) and pseudomonads (Pseudomonas). Inasmuch as the two genera were distinctly different by conventional taxonomic criteria, it was supposed that chances were improved for differentiating them by means of their infrared spectra. The prospects for differentiation of species in the genus Bacillus seemed excellent also because the taxonomic relationships had recently been deduced by Dr. N. R. Smith who had distinguished 19 species. Among the pseudomonads such distinctions were not as clear-cut, but the group was under investigation at the Northern Branch to discover its systematic relationships. Ultimately, some representation of 32 genera were included in the survey.

B. EXPERIMENTAL PROCEDURES:

1. Growth of Microorganisms

Microorganisms.--All microorganisms were from the Culture Collection of the Northern Utilization Research Branch.

Media.--The microorganisms were for the most part grown on Fortified Tryptose Agar, but some strains which failed to grow on it or which grew in atypical fashion were cultured on TGY, MY, or Cutters agar. In a study of the effect of medium upon the infrared spectra, a variety of media were used. The composition of these media were given in Quarterly Reports and need not be repeated here.

Condition of Growth.--Cells were grown usually on the surface of agar slants or plates and were routinely incubated at 30° C., except in those instances where sufficient growth could only be obtained by growth at a higher or lower temperature. The age of the cultures at time of harvest was 24 hours, except that most of the molds required an extension of time to a week or more in order to sporulate. Before recording the spectrum of any bacterium, the culture was transferred serially three times in order to invigorate the culture and to exhaust the cells of stored nutrilites accumulated on the stock culture medium. This was a precaution against introduction of variation from this cause.

2. Preparation of Bacterial Films

Most films were prepared by one or both of two methods: (1) The random smear method and (2) the wedge method of the Robert A. Taft Sanitary Engineering group. An attempt was made to adjust film thickness on basis of the optical density of bacterial suspensions, but it was not successful.

The random smear preparation was made by taking bacterial growth from Petri dishes on (usually) 107A medium. A slurry with water was made on a silver chloride plate. Usually two plates were prepared of each growth. These were dried in a horizontal position, then covered with another silver chloride for handling and placed in the spectrophotometer.

In the wedge method the slurry was made in the same manner as above, except that a small amount of a wetting agent (sodium lauryl sulfonate) was added. The amount of wetting agent was not enough to appear in the spectrum. The plate was dried in an inclined position in order to give a wedge or prism-shaped sample. After drying, another silver chloride plate was taped over the film.

3. Daily Instrument Check

The Perkin-Elmer Model 21 spectrophotometer was checked each day with a bacterial film reserved as a reference standard. This bacterium had a very strong 5.7 micron band which was the sharpest band observed

in microorganism spectra. If differences appeared between duplicate spectra of a given microorganism growth other than those caused by film thickness or instrumental scale factors, the instrument was checked for reproducibility on the reference film. Any instrumental difficulties were corrected before recording further spectra.

4. Procedure of Recording Infrared Curves

Almost all curves were recorded with a 5-inch transmission scale. This was obtained by adjusting the instrument with two silver chloride plates in the comparison beam which were similar in surface condition to the sample plates. Some early curves were taken without silver chloride plates in the comparison beam. In this procedure the transmission scale is not constant over the wavelength range, since surface scratches on the plates reduce the intensity of the transmitted beam by scattering more strongly at short than at long wavelengths.

All random smear films were placed in a fixed centered position with spectrometer. Wedge films were held in a modified microscope mechanical stage in order that the proper thickness could be found by movement with respect to the beam. The stage was adjusted until the transmission at 7.2 microns wavelength was about 40 percent. This was followed by adjustment of transmission scale at 5.25 microns to 5 inches or 100 percent (assuming no absorption at this wavelength). The transmission was then remeasured at 7.2 microns and the thickness adjusted until the transmission was exactly 40 percent. Following this, the transmission was measured at 6.05 microns. All films had an absorption maximum at this wavelength and if the transmission was higher than 5 percent (due to holes in film) the pen position was adjusted to this value. This amounted to an adjustment of zero. When this was done, which seldom happened, the cycle of the three wavelength readings and any necessary adjustments had to be repeated. After the transmission scale was in satisfactory adjustment, the record of the film was taken from 3 to 13 microns.

C. EFFECT OF NUTRITION UPON THE INFRARED SPECTRA OF BACTERIA:

When this project was first presented to us we were warned of its empirical nature. It was pointed out that the spectrum given by a strain varied depending upon the age of the culture, the composition of the medium upon which it was grown, temperature of incubation, etc. We were urged to use the Fortified Tryptose Agar 107A because most of the work at Camp Detrick had been with cells grown thereon. We accepted this as our standard medium and also agreed to use 24 hours as an arbitrary age at which to make our preparations; 37° C. was likewise accepted as the standard incubation temperature. As time progressed we were forced to change each of these standards. The first change came about when the makers of Tryptose Agar changed its composition by adding 5 mg./l. of thiamine HCl. The medium with the increased thiamine content was designated 107AT to distinguish it from the old 107A. We concluded that the effects of this medium change were inconsequential inasmuch as the

spectra of selected test organisms were classified in the same types. Later, the manufacturers of Tryptose Agar again changed the medium, this time returning to the original formula. We, however, continued to use 107AT medium. This was possible by supplementing the medium with thiamine-HCl.

At the first conference on infrared differentiation of microorganisms held at Camp Detrick in April 1953, it had been decided that it would be wise to transfer an organism serially on the standard medium long enough to insure that stored nutritives from another medium would not affect the spectrum. The third serial transfer on 107AT medium was chosen as probably free from this danger. It was our practice at the Northern Branch to repeat each strain at a later date, and so we were led to the expedient of keeping the second serial transfer as a stock for the repeat preparation. It soon became evident that 107AT was a poor medium for carrying stock culture since many died or subsequently failed to grow very well. We, therefore, fell back to our customary tryptose-glucose-yeast extract medium (TGY) which had for years been serving satisfactorily in maintaining the stock cultures of the Culture Collection. When many strains selected for survey failed to grow well enough on 107AT to permit satisfactory film formation, it was decided to change over to TGY as our standard medium. This was done just as we were beginning to delve into the aerobic sporeformers. Among those which had already been run were some previously relegated to types D and E which were distinguished from the others by the presence of a 5.7 micron band and other subsidiary bands. It was with some surprise that we found such strains, after growth on TGY, to yield spectra either devoid of the 5.7 micron band complex or showing considerably less absorption at these wavelengths. This was our first confirmation that medium composition was important in determining the shape of the infrared curve.

Because of the above-described sequence of events, we decided to investigate the effect of medium. For this purpose we selected 23 strains representing all types of responses on 107AT and TGY (i.e., no 5.7 micron band complex, a small 5.7 micron band and reduced absorption in the subsidiary bands, strong 5.7 micron band complex and those which produced a 5.7 micron band in one medium and not in the other). We first attempted to assign responsibility for the 5.7 micron band response in 107AT to one of the major components, tryptose and glucose. Figure 1 shows the results of this attempt. The glucose in the medium is obviously necessary to evoke the 5.7 micron band complex contour. This being the case, we next wished to discover if the complexity of the nitrogen source had any effect. Figure 2 shows that the effect is minimal but that use of NH_4NO_3 in place of more complex forms of nitrogen is advantageous because the transmission peaks and valleys are more clearly delineated, especially at 8.9, 9.1, and 9.45 microns. In Figure 3 a similar comparison with a non-"E"-type strain is shown. As in the E-type, the differences are not great. It would appear that the part played by the nitrogen source is not great except that the luxuriance of growth is dependent upon an adequate supply, and the more complex forms seem to enhance the amount of growth.

If glucose is the inciting agent of the 5.7 micron band complex, several questions remain to be answered. In the first place, what will be the effect on the curve of different concentrations of glucose? Secondly, is glucose unique or will other carbon compounds substitute for it? The first question was pursued first. Figure 4 shows that the glucose concentration in the range of 0.5 to 2 percent is of little or no account in affecting the shape of the curve of a non-"E"-type organism. Quite the contrary may be the case with an "E"-type strain such as B. megaterium, NRS-894, as is demonstrated in Figure 5. However, another strain of this species, NRRL B-349, shows little difference in response to the same levels of glucose. This is depicted in Figure 6. Our explanation for this inconsistency of behavior will be presented during a discussion of the studies of curves of cultures of different ages. The effect of 4 percent glucose was in each case essentially the same as 2 percent. We may conclude from these studies that the spectra of non-"E"-type aerobic sporeformers are unaffected by the level of glucose in a range from 0 to 4 percent. The curves for media devoid of added glucose are not shown, but they showed insignificant differences from those with glucose. It has been shown already that glucose is necessary to the development of the substance or substances responsible for the 5.7 micron band complex absorption. Figures 5 and 6 suggest a difference in the amount required by different type "E" strains, even of the same species.

The second question posed above concerned possible substitutes for glucose in the medium. The problem here was considered to involve either a relationship to length of the carbon chain or to specific linkages. In Figure 7 the effect of the length of the carbon chain is shown. Only succinic acid, representing a 4-carbon chain, failed to yield a 5.7 micron band and subsidiary bands, but this is not especially significant since B. megaterium, NRS-894, does produce a typical "E"-type spectrum in media with this acid. Glucose showed the most typical response so it was decided to compare the suitability of several substitutes for glucose having 6-carbon atoms. From Figure 8 it may be concluded that galactose, mannitol, and fructose all are capable of evoking the 5.7 micron band complex in NRS-894. Not all 6-carbon atom compounds can do so, however, as is shown in Figure 9. D-mannose, potassium gluconate, and sorbitol lead to non-"E"-type spectra for the same strain. Again NRS-894 and B-349 do not behave alike when grown on the same medium. For instance (Figure 10) when sorbitol is the principal carbon source, NRS-894 yields a non-"E"-type of spectrum while the B-349 spectrum is a typical "E." Alternately, on succinic acid NRS-894 produces a typical "E" curve, while the B-349 is greatly modified.

Our observations and conclusions are greatly weakened by the fact that confirmatory curves were not run and thus there is danger that our conclusions are unreliable. However, it seems certain that the presence of the 5.7 micron band complex is dependent upon the presence of glucose in the medium or of one of several other carbon compounds which

are organic acids, alcohols, or hexoses, and that those of 3- or 6-carbon atoms probably serve better than 2-, 4-, or 5-carbon atom compounds. This approach to the problem was abandoned in favor of a return to surveying microorganisms under arbitrarily standardized conditions.

D. EFFECT OF PHYSIOLOGICAL AGE UPON THE INFRARED SPECTRA OF BACTERIA:

As noted earlier in this report, in the beginning the culture age at which films were made was standardized in order to avoid changes in spectra related to this factor. The lead of Camp Detrick was followed and 24-hour cultures were used routinely. We were aware that changes in replicate curves made from different cultures were probably explainable to some degree by the assumption of variations in the growth rate of the culture from one preparation to another. The result of any such variation would be that the physiological age might differ even though the chronological age was carefully controlled. To obtain evidence on the effect of this factor, the infrared spectra of selected strains were investigated at such a series of chronological ages as to embrace all the different phases of growth. Figures 11, 12, and 13 show the extremes of variation encountered with some of the test organisms through certain ages. In Figure 11 a non-"E"-type strain is involved. The 7-hour curve is quite different from that of cells from the same culture taken at 24 hours. Figure 12 shows that in "E"-type cultures the differences are radical and include decreases in absorption after 17 hours at many wavelengths where it was maximal at 12 hours. In B. megaterium, NRS-894, the spectral changes associated with growth to maturity are similar. One striking fact brought out in the study of this strain, which grows faster than B-349, is that the 5.7 micron band complex is readily recognized in the spectrum of cells only 4 hours of age. This is not a consequence of the substance being supplied by the inoculum. This appears certain because Figure 13 shows that aged cells have utilized the 5.7 micron band material so that the spectrum is no longer typical of an "E" curve.

The different rate of the 5.7 micron band substance in these two type strains of B. megaterium and the fact that it never is seen in spectra of a third type strain (NRS-895) is very interesting. A possible explanation was that NRS-895 produced the substance responsible for the 5.7 micron band complex, but metabolized it at such a rate that it never accumulated (NRS-894 apparently metabolizes the substance, but initially at a rate slower than it is synthesized). This proved to be untrue. Spectra of cells younger than 17 hours were not seen for lack of sufficient growth. However, the 5.7 micron band complex never was seen in cells aged 17, 24, 48, and 72 hours. These curves resembled those of typical B. subtilis which are non-"E" type.

Existence of these three types within a species is interesting and may serve to explain why B-349 cells did not show different responses to graded levels of glucose (Figure 6), while NRS-894 did (Figure 5). The

former does not metabolize the 5.7 micron band complex material so that sufficient accumulates even from 0.5 percent glucose to be evident in the spectrum. NRS-894, on the other hand, utilizes the material at such a rate that the synthesis rate exceeds it only when the glucose concentration is 1 percent or higher.

From these two phases of the investigation, we have seen the considerable variation which may be induced by manipulating either the culture medium or culture age at the time of making a film. It is obvious that there is diversity of behavior even among strains of the same species, and that standardization of procedure may obscure some differences. For instance, NRS-894 and B-349 are both type "E" strains and no reason is evident for supposing them to differ. Yet one accumulates the 5.7 micron band complex substance, while the other metabolizes it. This difference is apparent when the spectra of different aged cells are compared. Only in a medium containing 1 or more percent of glucose is it evident that NRS-894 and NRS-895, both strains of B. megaterium, differ markedly in their spectra.

The fact that the differences that are induced are often between strains of the same species, while different species of a genus and different genera of a family are practically indistinguishable, makes these observations of academic value only.

E. TABLE OF BACTERIA STUDIED:

Table 1 presents an alphabetical listing by genus and species of all bacteria grown and recorded. Columns are included which show the total number of curves (almost 4,000) obtained by the random smear or wedge techniques. The number of curves per strain varies from a high of 98 to a low of 1. The last column shows whether a 5.7 micron band is present in the curves of each strain.

F. DIVISION OF SPECTRA INTO GROUPS FOR FURTHER STUDY:

The simplest division of spectra into two groups is provided by the presence or absence of a 5.7 micron band. In all cases but one when the 5.7 band is present, there are strong bands at 7.6 and 8.5 microns and a complex carbohydrate band at 8.6 to 10.2 microns. A spectrum containing a typical 5.7 micron band is illustrated by the lower curve of Figure 14. It is most unfortunate for identification purposes that all these marked differences occur together. In the classification of spectra for Table 1, the presence of even a 1-percent transmission dip at 5.7 microns was considered enough to include the strain in the 5.7 micron group. Even so, only about 5 percent of our total population of 356 strains fall in this group. The extremes of intensities of the 5.7 band of strains included in this group are illustrated in Figure 14. Strains that gave curves such as the upper one also were considered, in differentiation studies to be described later, not to have a 5.7

micron band since such a slight absorption does not disturb the rest of the curve appreciably. Strains of Pseudomonas reptilivora B-963, B-964, and B-965, for example, are listed in both Table 8 and Figure 17.

While most species were consistent in the presence or absence of the 5.7 band, a few species had some strains with very strong 5.7 bands, whereas other strains of the same species gave no evidence of it. An extreme example, illustrated in Figure 15, is Bacillus megaterium. Table 2 lists species including some with weak (1 to 4 percent) 5.7 micron bands. These 7 species (5, if the ones with very weak 5.7 bands are omitted) show that very large differences exist among infrared spectra of authentic strains belonging to each of several species. This occurs in about 4 percent of our total of 145 species.

Table 3-A lists the genera which had strains with 5.7 bands. Also included are the total number of strains examined and the number and percentage showing 5.7 micron bands. Only two genera had 100 percent of their strains with this type spectrum, but these genera were represented by only two strains each. Thus, they are very poor samples.

Table 3-B lists those species where all strains have 5.7 bands. Bacillus cereus is the only species for which more than two strains were examined, and this is the only one even fairly represented. One of the other species had two strains, but the rest had only one strain each.

The great majority (95 percent) of strains listed in Table 1 have no easily distinguishable characteristics and are considered as a group in section F, where a method of obtaining corrected transmission data is described and attempts to use the corrected data for identification at all taxonomic levels are discussed.

G. GROUP WITH 5.7 MICRON BANDS:

As mentioned above, this group is not very large relative to the population of bacteria examined. With the exception of Nocardia rubra, all spectra having the 5.7 micron band also have bands at 7.6 and 8.5 microns. In Figure 16 the spectrum of Nocardia rubra is compared with a curve from Bacillus cereus. As can be seen, this one strain of Nocardia rubra has a very strong 5.7 band but the 7.6 band is very weak and the 8.5 micron band is completely missing. In our total population of almost 360 strains, this is the only one that can be uniquely identified.

The remainder of the curves with 5.7 bands are too steep in the slope of the long wavelength side of the carbohydrate band to permit correction of the transmission values by the method described later in this report.

Another method considered for classification was based on the strength of the 5.7 bands as measured by the difference in percent transmission between 5.7 and 5.8 microns. In Figure 17 this difference is given for all strains having the 5.7 band. The range of values found for different curves for each strain also is shown in Figure 17. The range in transmission difference for any strain is usually not very large. But, as can be seen, there is no chance for the general identification of strains, species, or genera by these values. Restricted groups of two or three strains, each representing single species or genera, however, would usually be identified by this means.

H. GENERIC DIFFERENTIATION OF PSEUDOMONAS AND BACILLUS:

As mentioned previously (July 1955 report), curves of Pseudomonas generally differ from those of Bacillus in sign of the slope of a straight line joining the absorption band at 7.2 microns with the band at 8.1 microns. This characteristic can be expressed simply as the algebraic difference in transmission at 8.1 microns minus that at 7.2 microns. A distribution of these differences for the curves of each strain by species shows that there is no strain or species differential to provide strain or species identification. There are the usual extreme values that could provide identification among selected strains or species in very restricted groups. In Table 4 strains are classified according to reproducibility of this characteristic of their spectra. As a measure of this reproducibility, the difference of the two extreme values of the transmission differences for each strain was used. It is seen that the curves of 3.1 percent of Pseudomonas strains had no differences of their values within each strain; however, 31.6 percent had a range of one percent. More than 50 percent of strains in both genera had a range of 2 percent or less which appears to be very good reproducibility of spectra over a one micron wavelength range.

Figure 18 shows the distribution in percentage of curves in each genus according to differences in transmission at 8.1 and 7.2 microns. The data are plotted to the nearest whole transmission unit. It is evident from the curves that the two genera are, in general, distinguishable by this means. If Pseudomonas strains are identified by curves having a transmission difference less than -1.5 units and Bacillus strains as those having a difference greater than -1.5 units, 93 percent of the former with 528 curves and 87 percent of the latter, 262 curves will be correctly classified by genus.

The curves of all other genera have been measured for this difference but, unfortunately, their differences all fall within the range of Pseudomonas and Bacillus. Therefore, this cannot provide a general generic identification except that restricted groups, if they are far apart in the general distribution, can be differentiated.

I. STATISTICAL STUDY OF TRANSMISSION DATA AT SELECTED WAVELENGTHS:

1. Introduction

The gratifying result that Pseudomonas and Bacillus infrared curves could be distinguished with 90 to 95 percent certainty by comparing the difference in transmission at two selected wavelengths has been discussed in the preceding section. Since this classification gave only two definite groups and a third indefinite group, many more such comparisons of transmission differences at other wavelengths would be needed for identification within genera. A search revealed no other similar transmission differences and it was concluded that a more general approach was needed to obtain numerical data on which to base a more general identification system. Absolute transmission data would, of course, be ideal but since this would be extremely difficult to obtain for bacterial samples, some system based on relative values appeared to be the only practical possibility.

Curves were studied looking for a measurement that would be independent of thickness and scale variations. A basis for making such a measurement was found in the relatively low slope of the long wavelength side of the carbohydrate band that extends from about 9.2 to 10.2 microns. This band has a transmission range from approximately 30 to 90 percent in case of a bacterial film of acceptable thickness. By projecting the transmission value of each band maximum or minimum onto this slope and taking the wavelength value corresponding to the point of intersection, transmission values were transformed to wavelength units. The method for making the measurements is illustrated in Figure 19.

Table 5 illustrates the agreement of percent transmission calculated from infrared curves of thick and thin sections of a bacterial film. The percent transmission of the standard thickness curve was read directly and is given in line 3. Direct readings taken from curves for thin and thick sections are given in lines 1 and 5. Lines 2 and 4 are calculated percent transmission for the thin and thick sections obtained by reading transmission wavelengths and converting them back to percent transmission by reading off the standard curve in the region 9.2 to 10.2 microns. Comparison of lines 2, 3, and 4 shows that there is good agreement between the corrected transmission values from thin and thick films with those obtained from a film of standard thickness. The new units are strictly independent of thickness and scale differences as can be seen from consideration of Lambert's law. Simply stated, if transmission values are equal at two wavelengths, at one film thickness or scale setting they will be equal at any thickness or scale. The long wavelength side of the carbohydrate band thus provides a continuous set of transmission values whereby transmissions at lower wavelengths can be transformed to a set of characteristic wavelengths. No arbitrary straight line or curve can be used for this purpose because it would not vary in the proper manner with bacterial film

thickness. We found that we could not measure precisely the wavelengths corresponding to weak band positions and consideration was restricted to the maxima and minima that are present in all curves between 6.1 and 8.5 microns. The 6.3 and 6.5 micron values were usually read on an extension of the slope and this is indicated in the tables by enclosing the value of transmission in parentheses. It is to be expected that these values will show considerably more variation because of these extrapolations.

The curves with the 5.7, 7.6, and 8.4 micron band complex present (old spectral Type E) could not be read in this manner because the carbohydrate slope was too steep and irregular as shown in Figure 14. These curves were placed in a separate group which contains only a few percent of the total microorganism infrared curves as discussed in Section F.

Characterization of the infrared curves by a set of numbers makes possible treatment of the infrared data by statistical methods and enables more quantitative conclusions to be drawn concerning possible identifications. Statistical terms used in the subsequent discussion are defined as follows:

- (1) "Average" refers to the ordinary arithmetical average:

$$\bar{x} = \frac{\sum x_i}{n}$$

- (2) "Weighted Average":

$$\bar{x} = \frac{\sum x_i k_i}{\sum k_i}$$

where k_i is the weighting factor.

In averaging genera, each genus is "weighted" according to the number of species. When averaging species, "weighting" is according to the number of strains.

- (3) "Standard Deviation":

$$s.d. = \left(\frac{\sum (x_i - \bar{x})^2}{n - 1} \right)^{1/2}$$

This is an expression of the dispersion of the data about their average.

- (4) "Variance" is the square of the standard deviation.

- (5) "t" value or "t" test is the ratio of the difference of average values for some property of two groups to the pooled standard deviation

of this property for the two groups. The assumption that no significant difference exists between the groups is tested by determining the probability of occurrence of the observed difference in average if the groups represent random selections from a large group.

(6) "F ratio" or "F value" is the ratio of the variance of the group to the average variance of the subgroups. The probability of exceeding certain values by random selection or chance has been tabulated in standard references (depending on degrees of freedom). A given set of subgroups are tested by comparing the observed F ratio in standard tables with the "critical" value in the standard tables which would be exceeded only 1 time in 100 by chance.

(7) "Degrees of Freedom." Since we will have occasion to speak of degrees of freedom throughout this report, it is well to define the expression. If n items are averaged there is the loss of one variable by averaging, since only $n-1$ arbitrary items can be set down without changing the average. The last must then be chosen to preserve the average. Hence, in a "t test" involving two species of 13 and 17 strains, respectively, the total degrees of freedom, DF , = $(13-1) + (17-1) = 28$. Similarly, in an F test involving a comparison of variances of three species of two strains each we have $\frac{DF_{\text{species}}}{DF_{\text{strain}}} =$

$$\frac{3-1}{(2-1) + (2-1) + (2-1)} = \frac{2}{3} \text{ and we enter the standard table with this value.}$$

In Figure 20 the possibilities for distinguishing three species are illustrated graphically. Three possibilities exist, labelled A, B, and C. In case A, the F ratio would be less than the critical F ratio so that the three species would be considered to belong to the same population or group. In case B, the F ratio has increased. We assume it is larger than the critical value so that the three species cannot be considered as different samples of the same population. They would not be identifiable, however, because of the large mutual overlap. If species 2 were not present, species 1 and 3 would be distinguishable in most cases. In case C, the F ratio is far larger than the critical value so that the chance of the three species forming a single population is very small. Because the distribution of values of the species are well separated, they would be easily distinguished. The assumption is made, of course, that only strains from these three species can be present.

2. Methods of Obtaining Data

Figure 19 shows a typical microorganism infrared curve and is marked to indicate the method of determining transmission values for the statistical study. The eight maxima and minima indicated are those common to all curves except those with appreciable 5.7 micron band which are treated as a separate group. Horizontal lines are drawn parallel to the wavelength scale through each selected band position. A perpendicular

is dropped from where the lines intersect the long wavelength side of the carbohydrate band or its curved extension. The wavelengths of these perpendicular lines are determined to the nearest one hundredths of a micron and listed without a decimal point and called "transmission values in centimicrons." For example, the 6.9 micron band maximum is read as a transmission wavelength of 974 centimicrons. Repeated transmission wavelength readings of the same spectrum agree to \pm centimicron. To save a great deal of time or chances for error and to identify the method of determining corrected transmission values, all tabulations and calculations, except for Table 5, will be based on transmission wavelength values.

As is evident from Figure 19, a range of transmission of about 60 percent (20 to 80) are covered in about 1 micron (9 to 10) or 100 centimicrons. If this were a straight line, then 1 percent change in transmission corresponds to an average value of about 2 centimicrons so that this is a rather sensitive scale.

Two extreme variations as well as the standard thickness of a wedge film were run. The curves are presented in Figure 21. The center curve is for the selected thickness, usually called "standard thickness." The upper curve is about 75 percent and the bottom curve is about 150 percent of the standard thickness. Transmission wavelengths were read for those 3 curves and a sample of these data is given in lines 6, 7, and 8 of Table 5 for the wavelengths of band positions as given along the top of the table. Lines 1, 3, and 5 give the measured transmissions in percent as read. Lines 2 and 4 give the corrected percent transmissions for the thin and thick curves translated from transmission wavelengths to percent transmission using the standard thickness curve for this transformation. The differences of lines 2, 3, and 4 vary from 0 to a maximum of 4 as compared to lines 1, 3, and 5 which vary from a minimum of 7 to a maximum of 16. Usually the standard deviations are reduced to about one-fifth of the value of that for uncorrected data. The small differences in lines 2, 3, and 4 are likely due to variations in the silver chloride transmission, although some variations appear as though they must be due to variable composition in the wedge sample. This gain in uniformity of corrected data appeared so good that all curves were read this way to give data that could be statistically evaluated.

3. Data and Statistical Tables

Table 6 presents a distribution of spectra by genus, number of species, strains, and curves in each genus of the group used in the statistical study. Although 31 genera are represented, about one-third of the total species and two-thirds of the total strains are in the two genera Pseudomonas and Bacillus. These account for one-half of the total infrared curves. Slightly over one-third of the genera are represented by single strains. This is undesirable in a statistical study but in some cases no other strains were available or, if available, they would not grow under the desired conditions.

Table 7 presents a more detailed distribution showing the number of strains per species. The number of strains per species varies from a high of 59 for one species to a low of one for 78 species. Over one-half of the total number of species are represented by one strain each.

Table 8 presents in alphabetical order, according to genus, the transmission values in centimicron units at selected band maxima and minima positions for each curve of each strain used in the statistical study. This is then the most detailed listing of the data and requires some 50 pages. For most strains data are listed for 4 curves. However, as many as 13 were used in Serratia marcescens NRRL B-284, but only one was available for several strains. Data were excluded if their inclusion would have doubled the standard deviation. Transmission values in parentheses were read on an extrapolated curve.

Table 9 presents the average (av.) and standard deviation (s.d.) of the transmission values for each strain listed in Table 4. The number of curves from which measurements were taken for each strain is tabulated in the last column; this will permit judgment of the relative value of differences in data. As can be seen, the standard deviation of transmission values varies greatly at different wavelengths for each strain and commonly has a range of severalfold. The average standard deviation is about 3 or 4 units which corresponds to about 2 percent in percentage transmission. There appears to be no wavelength position which has a small standard deviation for all or most strains.

Table 10 presents species averages (Av.) transmission data. A statistical study of variance can be applied to these data to determine whether the average transmission values of the species vary more than the transmission values of curves in the individual strains. In other words, the test is to determine whether the curves of the species make up a single population among which the individual strains cannot be distinguished or whether the strains are characterized by groups of curves with smaller variance than the species. In the latter case, differentiation or identification of strains may be possible.

The first line for each species gives the average transmission value (in centimicrons) at each selected wavelength and is the average of the strain averages of Table 9. The second line for each species gives the average variance within strains (var. 1) and is derived from the standard deviations given in Table 9 by squaring and then averaging them. The third line for each species gives the variance of the averages of the strains within each species (var. 2) and is the square of the standard deviation (s.d. 2) given in the fifth line. The fourth line for each species gives the ratio of the two variances and is called the "F" ratio or value. In the column headed "group," the first entry for each species is the number of strains for that species and the second entry is the total number of curves. The last column gives the "F" ratio that would be exceeded only 1 percent of the time by

chance and is usually called the critical "F" value. The critical value varies with the size of the two groups involved, in this case the number of strains and the number of curves. It will be noted that the "F" ratio usually is greater than the critical value. The results in these tables will be discussed later.

Table 11 presents weighted averages of transmission values and variances for each genus and the species comprising each genus. The entries for each genus in the first column have the same meanings as in Table 10 except that the two groups considered are species and strains rather than strains and infrared curves. There are a number of genera having species represented by one strain each and, therefore, have no variance between strains of a species. In order to include these, at this level, the variance between species is compared to the variance between curves in a species. Where this procedure is followed the resulting values are marked with asterisks.

Entries in the column headed "Group" represent, in order, the number of species in each genus, the number of strains, and last, the number of curves involved. Average (av.) is the average of the species averages of Table 10 for each genus. The standard deviation (s.d. 2) is that for the species making up the genus group. The very large critical "F" ratios, such as 4,052 for Achromobacter (the fourth genus), are a result of having only two species and, therefore, one degree of freedom. If comparisons were made at the 10-percent instead of the 1-percent probability level, the critical "F" value would be reduced to 50. This points up the need for large numbers of species in making a statistical treatment.

Table 12 (item 1) presents statistical data for all genera listed in Table 7 considered as a single group. Line 1 gives the weighted average of the genus averages of the preceding table. Make-up of the group considered is given in the next to the last column. The numbers entered there signify that 31 genera were involved with 133 species, 310 strains, and 1,232 curves. It may be noted both variance 1 and 2 are rather large, so that the "F" ratios are not as large and variable as at lower taxonomic levels. The other two items in Table 12 are restricted groups of the better populated genera and will be discussed later.

Table 13 presents statistical "F" test data for various groups that will be considered in later discussion in attempts to identify species or strains in restricted groups.

Table 14 presents various "t" tests which are statistical tests restricted to comparison of two groups. This test is more easily interpreted than the "F" test in the sense of knowing the probability of the particular "t" value being exceeded by chance.

The first column is labelled "item" and this will be used to identify the groups being considered; the second column gives group designations; the third, gives the wavelength position at which comparison is made; the fourth, gives the difference in centimicrons of the averages of the two groups; the fifth and sixth, give the squared standard deviations or variances of the two groups under consideration which are given the general designation \underline{m} and \underline{n} ; the seventh, gives the weighted average variance; the eighth column gives the square root of the weighted average variance or average standard deviation of the two groups; the ninth pair of columns gives the populations of the groups \underline{m} and \underline{n} being considered; the tenth, gives a weighting factor involving the two populations; the eleventh, gives the "t" value which is used in entering statistical tables together with the degrees of freedom ($m + n - 2$); the twelfth column gives the table value of the probability of exceeding the "t" value by chance; and the thirteenth and the last column gives the unit of population being considered.

4. Discussion of Statistical Tables

a. Differentiation of Genera

Tables 9 to 14 were built up by taxonomic levels beginning with a comparison of curves of a strain and proceeding to comparisons of genera. It seems best, however, to discuss them in the reverse order because fewer groups are involved at the highest level. Therefore, we will start with Table 12 in which item 1 considers all genera as one group. The last line of item 1 gives the standard deviation (s.d. 2) of transmission values at the selected wavelengths for all genera considered as a single group. There is about a twofold range in standard deviation, varying from a low of 19.9 at 7.5 microns to a high of 43.7 centimicrons at 6.5 microns. These values correspond to a range in percent transmission from about 10 to 22. This result suggests that 7.5 microns is the wavelength at which sample thickness could be adjusted to give a common transmission value for all curves with the least total variation at other wavelengths. The standard deviation at 7.2 microns is only slightly greater, however, and this is the wavelength we chose for selection of film thickness in the wedge film technique.

Most of the "F" ratios in Table 12 exceed the critical ratio of 2.03. Therefore, this collection of genera should not be considered as a single homogeneous or indistinguishable group. Best possibility of differentiating genera at a single wavelength should be at 7.0 microns at which the transmission values have the largest "F" value (7.10). A distribution of the average transmission values of each genus taken from Table 7 is shown in Figure 22. In this figure the name of each genus is given followed by the numbers giving the total species, strains, and curves. Unfortunately, the two most populated genera, Pseudomonas and Bacillus, have averages 980 and 981, differing by only 1 centimicron. Therefore, there would be no possibility of

distinguishing them at this wavelength. The next most populated genus is Acetobacter with 18 species. At 7.0 microns its average transmission value is 15 centimicrons greater than that of Pseudomonas. To test whether curves of Acetobacter and Pseudomonas could be distinguished at this wavelength, a distribution was plotted and is given in Figure 23. Pseudomonas values are peaked whereas Acetobacter's are not and both genera have the same wide range, making identification appear impossible. This conclusion, of course, would change if the range of transmission values for Acetobacter could be narrowed, for example, by other growth conditions and yet not change the average value.

The large "F" ratios in item 1 of Table 12 result from genera with very small populations and it was desirable to apply the "F" test to Pseudomonas and Bacillus, the genera with the largest populations. The result is given in Table 12, item 2. The "F" values are greatly different from those of all genera as a group and, moreover, all "F" ratios are below the critical value of 4.08, except at 8.1 microns where the value is 4.22. This is one of the two wavelengths, 8.1 and 7.2 microns, used in differentiating these two genera by the test described in Section E. At 7.2 microns the "F" ratio is 0.54 and this low value results mainly from the high standard deviation of Bacillus as shown in Table 11. The average transmission of Bacillus is 12.6 units greater than Pseudomonas at 8.1 microns, but 5.9 units less at 7.2 microns, making a total difference of 18.5 centimicron units or about 10 percent difference expressed in percent transmission. Difference in percentage transmission is, of course, much easier to measure than transmission wavelength and would be the better choice for making identification of these genera. This "F" test shows that with the present reproducibility of species averages, there is no other wavelength position for possible subgrouping of Bacillus and Pseudomonas.

In order to obtain a better measure of the difference between Pseudomonas and Bacillus at 8.1 microns, a "t" test was applied using species as the unit. The result is given in Table 14, item 18. The "t" value, 2.05, would be given by chance only five times in 100. In other words, genus identification should be possible for Pseudomonas and Bacillus on the basis of species averages transmission values at 8.1 microns. Since a species average is difficult to obtain, impossible in the case of an unknown strain of these genera, a "t" test using individual curve transmission values is given in Table 14, item 19. The difference of averages (column 4) is 11.8 rather than 12.66 found in item 18, because of the earlier assumption that all strains are equally represented by 4 curves. The "t" value now becomes 12.25 which would be given by two samples of a single population only once in a thousand times by chance alone. Strains of the two genera, therefore, should be differentiable, and in Section E it was shown that curves could be identified correctly for about 90 percent of strains of these genera.

Since there is such a large difference in the number of wavelengths at which significant differences occur for the two genera with the largest populations as compared to all genera, it is interesting to

examine the effect of adding the third most populated genus, Acetobacter, which has 18 species. The "F" test is given in Table 12, item 3. Standard deviations at all wavelengths are increased greatly by adding Acetobacter, and all "F" values are above the critical ratio. Even though Acetobacter is a much smaller group than either Pseudomonas or Bacillus, it has introduced so much variation that the statistical conclusion is that the three genera should not be treated as a single group at any of the selected wavelengths. A distribution of the curves (data of Table 8) of each genus is given in Figure 24 for transmission values at 8.5 microns, the position of greatest "F" value (the "F" value at 6.3 microns, although larger, is based on extrapolated data and is not considered as reliable). Pseudomonas and Bacillus have peaked distributions but Acetobacter, with the smallest group, has as wide a distribution as the other two genera and gives very little indication of a peak. This discourages any further attempt to distinguish these three genera.

b. Differentiation of Species Within a Genus

Table 11 presents data at the genus level. Each genus is considered as a group of species except for those marked with asterisks which have only one strain for each species. For these the variance (var. 1) is that of the curves in each species rather than the variance of the averages of the strains. This results in some cases in a larger group (total of curves rather than strains) so that Alcaligenes, for example, has a critical "F" ratio of 13.7 because of 5 degrees of freedom, whereas Bacterium has a critical ratio of 4,052 with the same number of species (2) and the same number of curves (6) but has two strains in one species giving one degree of freedom. This makes the genus with the smaller number of strains appear as better data, but this, of course, is not correct. In those cases where the "F" values of these genera are above the critical ratio, a distribution of the curves will be given later so that the significance of the data can be seen.

Pseudomonas.--The genus Pseudomonas, the first item of Table 11, has "F" values above the critical ratio at all but one wavelength. Since P. aeruginosa provides almost one-half of the strains in Pseudomonas, a calculation of "F" values for the genus less this species is shown in Table 13, item 4. Now all "F" values are below the critical ratio (except for the less reliable value at 6.5 microns which is based on extrapolated data). This means that Pseudomonas less P. aeruginosa is a statistical single group and any attempt to sort it into species groups would be a failure with the present data.

Bacillus.--Standard deviations (s.d. 2) for the genus Bacillus (item 2, Table 11) are larger at all wavelengths than those of Pseudomonas. Range of species average data is therefore wider and so might give better subgrouping. Bacillus also has "F" values above the critical ratio at all wavelengths. The largest "F" ratio to be considered is 12.86 at 8.5 microns. The species transmission averages of Table 10 at 8.5

microns are distributed against number of species in Figure 25. They are rather widely distributed and look promising for subgrouping. To evaluate the effect of B. megaterium, the species which has the largest number of strains (20) and also the extreme high average transmission value, an "F" test was applied to the remainder of the genus. There was no marked lowering of "F" values after removal of B. megaterium. The two species with the next extreme average values, namely, B. laterosporus and B. coagulans, in addition to B. megaterium, also were eliminated and a new "F" test applied. This resulted in lower "F" values but, even so, the species could not be considered a single statistical group at the 99 percent probability level. To find homogeneous groups the three arrows marked in Figure 24 were used to form 4 subgroups, and "F" tests were performed on groups A and B. The tests are given as items 5 and 6 of Table 13, and the "F" values show that group A is a single population or group at all wavelengths, while group B may be considered a statistically single group at the 99 percent probability level at 6 wavelengths, including 8.5 microns. "F" values are so low at other wavelengths that any further subgrouping of group B is not considered feasible.

Since a better test of the possible differentiation of two groups is given by the "t" test, this test was made on groups A and B. Species were used as the basic unit and the results are given in Table 14, item 20. The probability that the observed difference between the two groups in transmission values at 8.5 microns would occur by chance is only 0.01, indicating that A and B may be distinguished. This test is based, however, on species averages of transmission values which in the case of an unknown strain is impossible to obtain.

As a test of the separability of Bacillus at the curve and strain level into the 4 groups of Figure 25, curves were sorted into groups according to the transmission values at 8.5 microns within the limits given in Figure 25. In the first trial the 290 individual curves of Bacillus were sorted on basis of the transmission values given in Figure 21. Sixty-two percent of the species were assigned to the same groups as given in Figure 25, where classification was based on species average transmission values. Twenty-five percent would be expected to be assigned correctly by chance. In a second trial, sorting was based on strain averages for transmission values as given in Table 9. In this case 68 percent of the strains were assigned in agreement with classification in Figure 25.

Remaining Genera.--The genus Acetobacter and all following genera in Table 11 that have at least one species with two or more strains (those without asterisks) are single groups by the "F" test. Therefore, it would not be feasible to consider any separation of these genera into subgroups of species. All other genera in Table 11 have only one strain for each species; variances are marked with asterisks to indicate, as discussed previously, that these are not really comparable in the "F" test to genera having better populated species.

Since very few curves are involved in the genera with species represented by only one strain, it is simple to plot the distribution of these curves according to transmission values at selected wavelengths. Such plots are given in Figure 26. Wavelengths were selected to be the most favorable for differentiation on basis of the "F" tests given in Table 11. The letter above each bar in Figure 26 identifies the strain (species) for which the data are given. Variation among the curves of a single strain can be seen, and the possibilities of differentiation among strains (species) can be judged. There is considerable variation in transmission range of the genera. Alcaligenes with 2 strains and Sarcina with 3 strains have the greatest range; Vibrio with 5 strains has the least. It would appear easy to identify strains (species) in Alcaligenes but impossible in Xanthomonas. It is interesting in Sarcina that 2 strains (species) have identical transmission values at the selected wavelength and the third strain has greatly different values. Similarly, Xanthomonas with 11 strains (species) has 8 of them much alike but 3 different.

Figure 26 illustrates graphically how identification may be possible in small groups, for example, a genus or genera involving a limited number of strains. Such conclusions may be misleading, however, as examination of all the genera in Figure 26 taken as a group will show.

c. Differentiation of Strains Within a Species

Table 10 presents the data at the species level. The four species with the largest number of strains, P. aeruginosa, P. reptilivora, B. megaterium, and B. subtilis have "F" values at all selected wavelengths above the critical ratio. The remaining species have many "F" values below as well as above the critical ratio. The four best populated species will be discussed individually below.

Pseudomonas aeruginosa.-- Pseudomonas aeruginosa with 59 strains is the best represented species. All "F" values are well above the critical ratio of 1.47. A distribution of strain average transmission values at 8.5 microns taken from Table 9, page 1 through 4, is presented in Figure 27. This distribution does not lend itself to a division of the species into groups of strains. As many as 10 strains have the same average transmission at 8.5 microns, even though this wavelength was characterized by the highest "F" value. The isolated pair of strains with the lowest transmission averages in Figure 27 could be separated from all the rest. This differentiation could also be made on the basis of individual curve transmission values.

According to the "F" values from Table 10, 8.1 microns is the next most favorable wavelength for distribution of P. aeruginosa strain average transmissions. This distribution, given in Figure 28, is better than that at 8.5 microns in that there are no more than 6 strains with the same average transmissions. The standard deviation is double that at 8.5 microns and the range is almost doubled. Most

strains are still too close together in values for subdividing into groups, although the few strains at each end of the range perhaps could be differentiated from the rest. Thus, even though this group with 59 strains does not constitute a single statistical group, the distribution of transmission values is too nearly continuous to permit subgrouping into several smaller groups.

Pseudomonas reptilivora.--This is the second best populated species of Pseudomonas but has only 7 strains. Table 10, page 1, shows that all the "F" values are above the critical ratio of 3.81, with the highest value of 55.7 at 8.5 microns. The distribution of strain averages from Table 9, page 9 at 8.5 microns, is shown in Figure 29, item 1. Even among such a small number of strains, two of them are found to have the same average transmission. There are two breaks in the distribution which are marked by vertical arrows in Figure 29. Subdivision at these transmission values defines three groups, labelled A, B, and C. Group A contains four strains, group B two strains, and group C one strain. Tests of the homogeneity of groups A and B, using individual curve transmission values, are given in Table 13, items 7 and 8. All "F" values are less than the critical ratio and, therefore, A and B constitute a single statistical group. The values of the individual transmission curves were sorted at 8.5 microns and all fell into the three groups correctly. If a group of microorganisms were restricted or by chance were all in group A, then identification would be impossible, but if it contained one of each group, then the contrary result would be obtained, i.e., that strain identification could be made. This shows again how misleading small groups can be and for this reason we will not go further into the less well-represented species of Pseudomonas.

Bacillus megaterium.--In discussion of the data for the genus Bacillus given in Table 10, page 4, consideration will be given to only 2 species, megaterium with 20 strains and subtilus with 14 strains. In B. megaterium all "F" values are above the critical ratio of 2.20, with the largest value of 30.2 at 8.1 microns. A distribution of strain averages from Table 9 is shown in Figure 29, item 2. The distribution is flat with no more than 2 strains at a single value, but there does not appear to be any logical position for subdivision into nearly equally sized groups. A distribution of strain averages at 7.2 microns, the wavelength having the second largest "F" value, is given in Figure 29, item 3. There are two gaps in the distribution--one, centered at 971 centimicrons, divides 19 of the strains into two groups of 8 and 11 each, and the other, centered near 948 centimicrons, that sets apart a single strain at the extreme left of the transmission scale. Arrows mark these positions in Figure 29 and divide the species into three groups, A, B, and C. The "t" test (Table 14, item 1) applied to groups B and C, using strain averages, shows that these groups should not be treated as a single group.

The first of these is the fact that the system is not self-sufficient. It is necessary to import a large quantity of raw materials from abroad, and this is a serious disadvantage. The second is the fact that the system is not very flexible. It is not possible to change the system very easily, and this is a serious disadvantage. The third is the fact that the system is not very efficient. It is not possible to produce goods very cheaply, and this is a serious disadvantage.

The fourth is the fact that the system is not very popular. It is not possible to get the public to accept the system, and this is a serious disadvantage. The fifth is the fact that the system is not very secure. It is not possible to protect the system from foreign interference, and this is a serious disadvantage. The sixth is the fact that the system is not very stable. It is not possible to keep the system for a long time, and this is a serious disadvantage. The seventh is the fact that the system is not very adaptable. It is not possible to change the system to suit the needs of the country, and this is a serious disadvantage. The eighth is the fact that the system is not very effective. It is not possible to achieve the desired results, and this is a serious disadvantage. The ninth is the fact that the system is not very efficient. It is not possible to produce goods very cheaply, and this is a serious disadvantage. The tenth is the fact that the system is not very flexible. It is not possible to change the system very easily, and this is a serious disadvantage.

The eleventh is the fact that the system is not very popular. It is not possible to get the public to accept the system, and this is a serious disadvantage. The twelfth is the fact that the system is not very secure. It is not possible to protect the system from foreign interference, and this is a serious disadvantage. The thirteenth is the fact that the system is not very stable. It is not possible to keep the system for a long time, and this is a serious disadvantage. The fourteenth is the fact that the system is not very adaptable. It is not possible to change the system to suit the needs of the country, and this is a serious disadvantage. The fifteenth is the fact that the system is not very effective. It is not possible to achieve the desired results, and this is a serious disadvantage. The sixteenth is the fact that the system is not very efficient. It is not possible to produce goods very cheaply, and this is a serious disadvantage. The seventeenth is the fact that the system is not very flexible. It is not possible to change the system very easily, and this is a serious disadvantage. The eighteenth is the fact that the system is not very popular. It is not possible to get the public to accept the system, and this is a serious disadvantage. The nineteenth is the fact that the system is not very secure. It is not possible to protect the system from foreign interference, and this is a serious disadvantage. The twentieth is the fact that the system is not very stable. It is not possible to keep the system for a long time, and this is a serious disadvantage.

As a further test, transmission data at 7.2 microns from individual curves taken from Table 8, page 20-23, are distributed in Figure 30. Seventy-six of the 80 curves for B. megaterium fall into the same groups as were assigned on the basis of strain averages in Figure 29, item 3. Two of the 4 in group C, that belong to group B when classified according to strain averages, were from one growth of strain NRS-627.

To find other possible positions for subdivision of B. megaterium, "F" tests were applied to groups B and C individually, and the results are given in Table 13, items 1 and 2. "F" values for group B exceed the critical ratio at only the two wavelengths, 8.5 and 8.1 microns. At the former, the critical ratio is barely exceeded, but at the latter the "F" value is over four times the critical value and subgrouping at this wavelength should be possible. A distribution of the strain average transmission values (Table 5, page 12) of this group at 8.1 microns is shown in Figure 29, item 4. The distribution of strain averages appears well spread and a proposed division into 5 subgroups of 2 or less strain each is indicated by the vertical arrows. Support that these subgroups may be treated as single groups is given by "t" tests on the individual curve data of the subgroups which have 2 strains in each. Results are presented in Table 14, items 4, 5, and 8. Further test of the validity of these subgroups of group B was made by "t" tests on neighboring subgroups. These tests indicate that there is high probability that these are individual groups.

Group C of B. megaterium (Table 13, item 2) also has "F" values at all wavelengths above the critical ratio. The largest "F" value is about ten times the critical ratio and occurs at 8.1 microns. However, distribution of strain averages (Table 9, page 12) at this wavelength, as given in Figure 29, item 5, shows the separation to be poor. A better distribution resulted for strain average transmission values at 6.8 microns and is given as item 6, Figure 29. Vertical arrows in this figure define 5 subgroups which were examined further by the "t" test. The "t" test of item 10, Table 14, shows that the curves of the two strains in group C-2 are indistinguishable. Items 11 and 12, Table 14, show "t" tests based on an individual curve data for groups C-1 vs. C-2 and C-2 vs. C-3 that indicate there is a good probability for distinguishing these subgroups. In Table 14, items 13 and 14 show that for groups C-3 vs. C-4 and C-4 vs. C-5 strain averages must be used for even a fair probability of distinguishing them.

Since group C-4 is made up of 6 strains, an "F" test was applied to test their homogeneity. The result (Table 13, item 3) shows only one wavelength, 8.1 microns, where the "F" value is above the critical ratio. A distribution of strain averages for this subgroup at 8.1 microns is shown in Figure 29 as item 7. Four tentative subgroups are indicated by the vertical arrows. "T" tests based on curve transmissions (Table 14, items 15, 16, and 17) show that there is good probability the subgroups of C-4 can be distinguished. This places a maximum of three strains in one group (C4-a).

The first of these is the fact that the system is not a simple one, but a complex one, involving many different factors, and the second is the fact that the system is not a static one, but a dynamic one, involving many different factors.

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Figure 31 shows a complete sorting arrangement for the 29 strains of B. megaterium including (for completeness) the 9 strains that have the 5.7 micron band. In this scheme there are 9 groups having 1 strain each, 4 groups of 2 strains each, 1 group with 3 strains, and 1 group with the 9 strains having the 5.7 micron band. In sorting the individual curves of the 20 strains without the 5.7 micron band, the following successes were obtained where the figures in parentheses are the probabilities of obtaining the agreements by chance: All curves of 25 percent of the strains were correctly placed (chance, 2.4×10^{-5}); in another 25 percent of the strains, 3 out of the 4 curves of each strain were correctly placed (9.0×10^{-3}); 2 out of 4 curves of each strain for 30 percent were correctly placed (2.5×10^{-2}); 1 out of 4 curves of each strain for 15 percent of the strains were correctly placed (0.22) and in one strain no curves were correctly placed (0.75). The first three results had low probability of random occurrence but the last two had fairly large probability of chance.

Bacillus subtilis.--Subtilis is the next best populated species of Bacillus and is represented by 14 strains with 57 curves. Table 10, page 4, shows that all "F" values are above the critical ratio, but none are as large as the value for B. megaterium at 8.1 microns. The largest "F" ratio is at 8.5 microns and a distribution of strain averages from Table 9, page 15, at this wavelength is shown as item 8 in Figure 29. B. subtilis shows the least range of any species studied separated and this makes any further attempts to subdivide this species appear useless.

d. Conclusions of Statistical Study

The principal contribution of the statistical study is that it has provided a method for the quantitative examination of the differentiability of bacteria at each of several taxonomic levels. Although the present treatment has been limited in that comparisons of infrared curves have been made at only one wavelength at a time, there has been the advantage that large numbers of curves could easily be compared at the selected wavelengths. Results of the calculations indicated the wavelengths at which a given set of curves were statistically differentiable. Transmission data at these wavelengths could then be plotted for this set in the form of a frequency distribution plot, and the actual differentiation of the curves easily judged.

Best success in differentiating strains within a species was found for Bacillus megaterium. Twenty strains of this species were divided into 14 subgroups with no more than 3 strains in any subgroup. In other species, one or more strains could be readily differentiated from the rest, but in most cases there remained a larger group of non-differentiable strains.

In no case were all species of a single genus differentiated satisfactorily. Best success was found for Bacillus which could be divided

into two groups after disregarding the 5 most different species. Pseudomonas, however, showed a nearly continuous distribution of transmission values for its strains, and it appeared impossible to subdivide this genus into species groups based on the infrared data.

Two genera, Bacillus and Pseudomonas, both represented by large numbers of strains, could be identified with about 90 percent success on the basis of transmission values at 8.1 microns. However, the distribution of the third largest genus studied, Acetobacter, overlapped Bacillus and Pseudomonas and greatly lowered the probability of successful identification.

It would thus appear that the infrared method can provide identification at any level of relationship if the group is restricted. In unrestricted groups, transmission values appear to be continuously distributed and make identification impossible by simple sorting at single wavelengths. The restrictions required to limit the group sufficiently may, of course, render the method valueless for many purposes.

There remains to be explored, however, the possibility of identification based on multiple correlation of transmission data at several wavelengths. Such a system may make the infrared method more generally applicable.

Table 1 (Page 1)

DISTRIBUTION OF INFRARED CURVES BY GENUS, SPECIES, STRAIN, TYPE OF FILM, AND BY PRESENCE OR ABSENCE OF 5.7 MICRON BAND

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Acetobacter</u>	: <u>aceti</u>	B578	5	0	-
	:	B581	2	0	-
	: <u>acetigenum</u>	B469	4	0	-
	: <u>acetosum</u>	B468	3	0	-
	: " var. <u>nair.</u>	B747	4	0	-
	: <u>acidum-mucosum</u>	B145	2	0	-
	:	B1303	2	0	-
	: <u>ascendens</u>	B56	2	0	-
	:	B1047	3	0	-
	: <u>capsulatum</u>	B1225	2	0	-
	: <u>gluconicum</u>	B64	2	0	-
	:	B471	2	0	-
	: <u>ketogenum</u>	B999	6	0	-
	: <u>kuetzingianum</u>	B62	2	0	-
	:	B472	2	0	-
	: <u>melanogenum</u>	B58	2	0	-
	:	B63	2	0	-
	: <u>mobile</u>	B146	3	0	-
	: <u>orleanse</u>	B55	3	0	-
	: <u>oxydans</u>	B147	2	0	-
	: <u>pasteurianum</u>	B752	3	0	-
	: <u>peroxydans</u>	B680	2	0	-
	:	B753	1	0	-
	: <u>rancens</u>	B65	3	0	-
	:	B754	3	0	-
	: <u>suboxydans</u>	B72	2	0	-
	:	B177	3	0	-
	: <u>turbidans</u>	B570	3	0	-
	:	B1026	5	0	-
	: <u>vini-acetati</u>	B1050	2	0	-
	: <u>viscosum</u>	B1039	1	0	-
	:	B1226	2	0	-
	: <u>xylinoides</u>	B1034	2	0	-
	: <u>xylinum</u>	B42	5	0	-
	:	B43	3	0	-
<u>Achromobacter</u>	: <u>ammonigenes</u>	B1323	2	0	-
	: <u>lacticum</u>	B551	3	0	-
	:	B552	2	0	-
<u>Aerobacter</u>	: <u>aerogenes</u>	B199	5	0	-
	:	B562	2	0	-
	: <u>cloacae</u>	B126	2	0	-
	:	B169	2	0	-
	:				

1. The purpose of this document is to provide a clear and concise summary of the project's progress and to identify any issues that need to be addressed.

Project Overview		Key Findings		Recommendations	
Project Name	Project Alpha	Findings	Recommendations	Findings	Recommendations
Project Manager	John Doe	Findings	Recommendations	Findings	Recommendations
Project Start Date	2023-01-01	Findings	Recommendations	Findings	Recommendations
Project End Date	2023-12-31	Findings	Recommendations	Findings	Recommendations
Project Status	In Progress	Findings	Recommendations	Findings	Recommendations
Project Budget	\$1,000,000	Findings	Recommendations	Findings	Recommendations
Project Scope	Develop a new software application	Findings	Recommendations	Findings	Recommendations
Project Risks	Low	Findings	Recommendations	Findings	Recommendations
Project Deliverables	Software application	Findings	Recommendations	Findings	Recommendations
Project Stakeholders	Client, Development Team, Marketing Team	Findings	Recommendations	Findings	Recommendations
Project Communication	Weekly status reports	Findings	Recommendations	Findings	Recommendations
Project Documentation	Project charter, Requirements document, Design document	Findings	Recommendations	Findings	Recommendations
Project Review	Monthly review meetings	Findings	Recommendations	Findings	Recommendations
Project Conclusion	Project completed successfully	Findings	Recommendations	Findings	Recommendations

Table 1 (Page 2)

Genus	Species	Strain	Film		5.7 μ band present
			Random	Wedge	
			smear		
<u>Aeromonas</u>	<u>hydrophila</u>	B909	6	0	-
		B910	3	0	-
	<u>ichthyosmia</u>	B926	3	0	-
	<u>punctata</u>	B914	5	0	-
		B928	1	0	-
	<u>salmonicida</u>	B1465	1	0	-
	<u>species</u>	B538	6	0	-
<u>Agrobacterium</u>	<u>radiobacter</u>	B164	2	0	-
		B181	2	0	-
	<u>rhizogenes</u>	B193	2	0	-
	<u>tumefaciens</u>	B36	2	0	-
		B37	2	0	-
<u>Alcaligenes</u>	<u>faecalis</u>	B170	2	0	-
	<u>viscosus</u>	B182	4	0	-
<u>Arthrobacter</u>	<u>citreus</u>	B1258	3	0	-
<u>Azotobacter</u>	<u>chroococcum</u>	B488	3	0	-
<u>Bacillus</u>	<u>alvei</u>	B383	8	3	-
		B385	6	9	-
		B386	0	3	-
	<u>brevis</u>	NRS604	9	0	-
	<u>cereus</u>	NRS305	35	4	+
		B344	98	4	+
		NRS645	37	8	+
		NRS721	47	13	+
		NRS808	48	4	+
	<u>cereus</u> var. <u>mycoides</u>	NRS306	27	3	+
		B346	32	4	+
		B347	30	4	+
		NRS912	32	4	+
	<u>cereus</u> var.				
	<u>thuringiensis</u>	NRS996	38	4	+
		NRS1124	28	4	+
		NRS1328	30	4	+
	<u>circulans</u>	B378	7	8	-
		B380	7	3	-
		NRS831	0	3	-
		NRS1136	0	4	-
	<u>coagulans</u>	NRS-T-13	0	4	-
		NRS609	3	0	-
		NRS795	8	3	-
		NRS796	0	4	-
	<u>firmus</u>	NRS613	11	0	-
		NRS854	5	1	-
		NRS855	0	1	-
		NRS858	0	5	-

Table 1 (Page 3)

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Bacillus</u> (cont'd.)	<u>laterosporus</u>	NRS314	11	3	-
		NRS340	4	4	-
		NRS347	0	3	-
		NRS590	0	3	-
	<u>lentus</u>	B396	8	1	-
		NRS883	7	2	-
	<u>licheniformis</u>	B571	40	4	+
		B1001	6	4	-
		NRS1263	11	8	-
		NRS1264	5	0	-
	<u>macerans</u>	B171	9	0	-
		B172	5	7	-
		NRS1093	0	5	-
		NRS1095	0	4	-
	<u>megaterium</u>	NRS245	0	4	+
		NRS308	34	4	-
		B349	68	8	+
		B350	0	4	-
		B351	0	4	-
		B352	0	4	+
		B353	0	4	+
		NRS607	0	4	-
		NRS608	0	4	-
		NRS610	0	4	-
		NRS623	0	4	-
		NRS627	0	4	-
		NRS822	0	4	-
		NRS824	0	4	-
		NRS828	0	4	-
		NRS829	0	4	-
		NRS835	0	4	-
		NRS837	0	4	-
		NRS872	0	4	-
		NRS892	37	4	-
		NRS893	0	3	+
		NRS894	76	6	+
		NRS895	36	4	-
		NRS907	0	4	-
		NRS923	0	4	-
		NRS931	0	4	-
		B938	0	4	+
		NRS951	0	4	+
		NRS952	0	4	+
	<u>pantothenicus</u>	NRS1317	9	2	-
		NRS1318	10	4	-
		NRS1319	0	3	-
		NRS1320	0	5	-

Table 1 (Page 4)

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Bacillus</u> (cont'd.)	<u>polymyxa</u>	B174	0	4	-
		B368	6	3	-
		B372	14	4	-
		NRS1105	0	4	-
	<u>pulvifaciens</u>	NRS1283	5	0	-
		NRS1284	5	2	-
		NRS1285	0	2	-
	<u>pumilus</u>	NRS272	7	4	-
		NRS630	7	4	-
		NRS939	0	6	-
		B1489	0	4	-
	<u>sphaericus</u>	NRS-T-156	0	4	-
		NRS344	7	4	-
		NRS348	5	4	-
		NRS966	0	4	-
	<u>subtilis</u>	B543	22	4	-
		B558	17	4	-
		NRS743	0	4	-
		NRS744	0	3	-
		B765	51	4	-
		B971	69	41	-
	<u>subtilis</u> var.				
	<u>aterrimus</u>	B362	6	4	-
		NRS653	7	4	-
		NRS659	0	4	-
		NRS740	0	6	-
	<u>subtilis</u> var.				
	<u>niger</u>	NRS264	6	4	-
		B364	5	4	-
		NRS650	0	4	-
		NRS651	0	4	-
	<u>subtilis</u> - <u>licheniformis</u>				
	intermed.				
	<u>technicus</u>	B972	35	4	+
		B675	2	4	-
	<u>species</u>	B1246	6	4	+
	<u>stewartii</u>	B28	3	0	-
		B158	2	0	-
<u>Brucella</u>	<u>bronchiseptica</u>	B140	2	0	-
<u>Cellulomonas</u>	<u>biazotea</u>	B401	2	0	-
	<u>udum</u>	B404	2	0	-
<u>Chromobacterium</u>	<u>violaceum</u>	B1020	4	0	-
<u>Clostridium</u>	<u>acetobutylicum</u>	B527	4	0	-
		B528	3	0	-

NAME	RESIDENCE	DATE	REMARKS
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1. [Illegible text]

2. [Illegible text]

3. [Illegible text]

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5. [Illegible text]

Table 1 (Page 5)

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Clostridium</u> (cont'd.)	<u>acetobutylicum</u>	B530	2	0	-
		B643	2	0	-
	<u>amylobacter</u>	B597	3	0	-
	<u>botulinum</u>	B1218	4	0	-
	<u>butylicum</u>	B466	1	0	-
		B593	2	0	-
	<u>butylicus</u>	B592	3	0	-
		B596	4	0	-
	<u>butyricum</u>	B1024	3	0	-
	<u>felsinum</u>	B308	1	0	-
	<u>pasteurianum</u>	B598	1	0	-
	<u>roseum</u>	B307	2	0	-
		B638	3	0	-
	<u>saccharo-</u>				
	<u>acetobutylicum</u>	B591	2	0	-
	<u>sporogenes</u>	B1219	2	0	-
	<u>tetani</u>	B563	2	0	-
	<u>species</u>	B536	2	0	-
		B594	4	0	-
		B616	3	0	-
<u>Corynebacterium</u>	<u>fascians</u>	B190	3	0	-
	<u>fimi</u>	B402	4	0	-
		B403	2	0	-
	<u>flaccumfaciens</u>	B729	3	0	-
	<u>michiganense</u>	B33	3	0	-
	<u>xerose</u>	B1379	8	0	-
<u>Cytophaga</u>	<u>hutchinsoniae</u>	B216	3	0	-
<u>Erwinia</u>	<u>amylovora</u>	B127	6	0	-
		B405	3	0	-
	<u>carotovora</u>	B35	2	0	-
		B422	4	0	-
<u>Escherichia</u>	<u>coli</u>	B210	3	0	-
		B281	7	0	-
		B1079	3	0	-
<u>Flavobacterium</u>	<u>aurantiacum</u>	B184	4	0	-
	<u>devorans</u>	B54	3	0	-
	<u>sulfureum</u>	B185	3	0	-
<u>Lactobacillus</u>	<u>acidophilus</u>	B629	1	0	-
	<u>bulgaricus</u>	B734	1	0	-
	<u>casei</u>	B441	6	0	-
	<u>casei</u> €	B442	6	0	-
	<u>delbrueckii</u>	B445	6	0	-
		B1042	6	0	-
	<u>fermenti</u>	B585	6	0	-
	<u>leichmannii</u>	B735w	6	0	-
		B1240	1	0	-

Table 1 (Page 6)

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Lactobacillus</u>					
(cont'd.)	<u>plantarum</u>	B227	5	0	-
		B531	6	0	-
(Strepto- bacterium)	<u>dextranicum</u>	B1254	6	0	-
		B1255	6	0	-
(Beta- bacterium)	<u>vermiforme</u>	B1127M	4	0	-
		B1139	2	0	-
<u>Leuconostoc</u>	<u>dextranicum</u>	B640	2	0	-
		B1145	3	0	-
	<u>mesenteroides</u>	B512F	7	0	-
		B523	2	0	-
		B742	7	0	-
		B1064	1	0	-
		B1065	1	0	-
		B1066	1	0	-
		B1142	6	0	-
<u>Micrococcus</u>	<u>conglomeratus</u>	B635	6	0	-
	<u>lysodeikticus</u>	B287	8	0	-
	<u>pyogenes</u>	B1317	6	0	-
		B1317P	2	0	-
		B1318	6	0	-
	<u>roseus</u>	B245	6	0	-
	<u>subcitreus</u>	B186	5	0	-
	species	B191	7	3	-
		B916	2	6	-
		B911	3	0	-
<u>Mycobacterium</u>	<u>phlei</u>	B609	2	0	-
		B610	3	0	-
	<u>smegmatis</u>	B612	6	0	-
<u>Mycoplana</u>	<u>dimorpha</u>	B1031	3	0	+
<u>Neisseria</u>	<u>perflava</u>	B1458	3	0	-
<u>Nocardia</u>	<u>coeliaca</u>	B1365	6	0	-
	<u>erythropolis</u>	B1532	3	0	-
	<u>globerula</u>	B1306	6	0	-
	<u>polychromogenes</u>	B1531	3	0	-
	<u>rubra</u>	B685	6	13	+
<u>Pediococcus</u>	<u>cerevisiae</u>	B1325	6	0	-
		B1326	6	0	-
<u>Proteus</u>	<u>ammoniae</u>	B420	6	0	-
	<u>anindologenes</u>	B418	6	0	-
	<u>mirabilis</u>	B400	6	0	-
	<u>morganii</u>	B540	6	0	-
	<u>vulgaris</u>	B123	6	0	-
		B415	6	0	-

Table 1 (Page 7)

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Pseudomonas</u>	<u>acidovorans</u>	B802	4	8	-
		B819	4	4	-
	<u>aeruginosa</u>	B7	4	4	-
		B12	4	5	-
		B23	1	4	-
		B26	4	4	-
		B27	4	4	-
		B79	2	4	-
		B189	1	4	-
		B211	3	4	-
		B217	3	3	-
		B218	3	4	-
		B219	2	4	-
		B220	4	4	-
		B221	4	4	-
		B241	5	4	-
		B247	2	4	-
		B248	1	4	-
		B249	0	4	-
		B250	2	4	-
		B255	1	4	-
		B256	1	4	-
		B257	4	5	-
		B260	3	3	-
		B264	1	0	-
		B265	4	4	-
		B275	1	4	-
		B282	2	4	-
		B323	4	4	-
		B325	1	4	-
		B428	1	4	-
		B431	1	4	-
		B450	4	4	-
		B451	1	4	-
		B452	2	4	-
		B534	2	4	-
		B716	2	4	-
		B743	1	4	-
		B771	4	4	-
		B786	1	4	-
		B800	4	4	-
		B804	9	3	-
		B822	0	4	-
		B853	4	4	-
		B903	4	4	-
		B904	1	4	-

Table 1 (Page 8)

Genus	Species	Strain	Film		5.7 u band present
			Random smear	Wedge	
<u>Pseudomonas</u> (cont'd.)	<u>aeruginosa</u> (cont'd.)	B937	1	4	-
		B982	1	4	-
		B996	3	0	-
		B997	1	4	-
		B1000	13	10	-
		B1019	7	4	-
		B1069	1	4	-
		B1080	1	4	-
		B1083	1	4	-
		B1087	1	4	-
		B1088	1	4	-
		B1235	2	4	-
		B1236	1	4	-
		B1247	1	5	-
		B1360	2	4	-
		B1361	36	8	-
		B1362	25	4	-
	<u>allicola</u>	B823	4	5	-
		B828	3	4	-
		B915	5	0	-
	<u>aminovorans</u>	B934	4	5	-
	<u>angulata</u>	B821	5	4	-
		B824	2	5	-
		B825	2	10	-
		B1056	1	0	-
	<u>apii</u>	B772	2	2	-
		B798	4	0	-
		B839	2	0	-
		B840	1	0	-
	<u>atrofaciens</u>	B773	2	4	-
		B827	1	4	-
	<u>aureofaciens</u>	B1543	3	0	-
	<u>barkeri</u>	B830	0	7	-
	<u>boreopolis</u>	B549	3	10	-
		B550	3	4	-
	<u>calco-acetica</u>	B803	5	4	-
		B933	3	8	-
	<u>caviae</u>	B966	0	4	-
		B967	0	5	-
		B968	3	5	-
	<u>cepacia</u>	B1101	0	4	+
	<u>chlororaphis</u>	B560	6	8	-
		B561	4	8	-
		B977	1	6	-
		B1095	3	7	-

Table 1 (Page 9)

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Pseudomonas</u> (cont'd.)	<u>chlororaphis</u> (cont'd.)	B1097	6	4	-
		B1098	5	4	-
		B1541	0	7	-
	<u>cichorii</u>	B832	1	5	-
	<u>coronafaciens</u>	B774	1	0	-
		B834	3	1	-
	<u>cruciviae</u>	B932	4	4	-
		B1021	4	8	-
		B1090	5	0	-
		B1091	2	0	+
	<u>delphinii</u>	B836	2	0	-
	<u>denitrificans</u>	B1028	2	4	-
	<u>desmolyticum</u>	B979	3	4	-
		B980	3	7	+
	<u>eisenbergii</u>	B993	3	4	-
		B994	1	8	-
		B995	2	4	-
		B1023	2	4	+
		B1245	1	4	-
	<u>fluorescens</u>	B10	3	4	-
		B11	10	5	-
		B253	6	4	-
		B258	3	4	-
		B1244	6	4	-
	<u>fragi</u>	B25	2	4	-
	<u>iodina</u>	B141	7	5	-
		B1536	0	4	-
		B1537	0	4	-
		B1540	0	4	-
	<u>mildenbergii</u>	B21	3	4	-
		B652	4	8	-
	<u>pavonacea</u>	B9	4	6	-
		B259	4	2	-
	<u>putida</u>	B13	3	9	-
		B805	3	8	-
	<u>reptilivora</u>	B6bs	6	4	-
		B66	3	4	-
		B285	3	4	-
		B334	3	4	-
		B908	2	0	-
		B963	4	10	+
		B964	6	4	+
		B965	3	10	+
	<u>stutzeri</u>	B775	1	7	-
		B927	2	10	-

Table 1 (Page 10)

Genus	Species	Strain	Film		5.7 μ band present
			Random smear	Wedge	
<u>Pseudomonas</u> (cont'd.)	<u>suis</u>	B1352	6	4	+
		B1093	6	4	+
		B1094	6	4	+
		B1423	8	4	-
		B1457	2	3	-
		B1464	2	0	-
<u>Rhodospirillum</u>	<u>rubrum</u>	B175	5	0	+
		B279	5	0	+
<u>Sarcina</u>	<u>flava</u>	B1262	6	0	-
	<u>lutea</u>	B1018	12	0	-
	<u>ureae</u>	B286	5	0	-
<u>Serratia</u>	<u>marcescens</u>	B284	16	0	-
		B1481	6	0	-
<u>Spirillum</u>	<u>serpens</u>	B331	6	0	-
	<u>virginianum</u>	B329	5	0	+
<u>Streptococcus</u>	<u>cremoris</u>	B634	6	0	-
	<u>faecalis</u>	B446	4	0	-
		B1295	1	0	-
	<u>lactis</u>	B633	1	0	-
	<u>species</u>	B639	2	0	-
		B641	2	0	-
	<u>zymogenes</u>	B1152	6	0	-
<u>Streptomyces</u>	<u>alni</u>	B1521	3	0	-
	<u>bikiniensis</u>	B1049	6	0	-
	<u>griseus</u>	B1078	3	0	-
<u>Vibrio</u>	<u>cyclosites</u>	B1022	4	0	-
	<u>neocistes</u>	B1037	6	0	-
	<u>percolans</u>	B1055	6	0	-
	<u>phosphorescens</u>	B144	6	0	-
	<u>rubicundus</u>	B782	2	0	+
	<u>tyrogeus</u>	B242	6	0	-
<u>Xanthomonas</u>	<u>begoniae</u>	B34	6	0	-
	<u>beticola</u>	B1092	6	0	-
	<u>campestis</u>	B1459	12	0	-
	<u>carotae</u>	B1008	6	0	-
	<u>geranii</u>	B1011	6	0	-
	<u>incanae</u>	B1012	6	0	-
	<u>juglandis</u>	B1013	6	0	-
	<u>malvacearum</u>	B215	6	0	-
	<u>phaseoli</u>	B1460	10	0	-
	<u>proteamaculans</u>	B987	6	0	-
	<u>pruni</u>	B1014	6	0	-
Unidentified		B29	5	4	-
		B653	6	5	-
		B728	2	7	-
		B990	10	7	-



Table 2

SPECIES WHICH HAVE STRAINS WITH AND WITHOUT 5.7 MICRON BANDS

Genus	:	Species	:	Total no. of strains	:	No. of strains with 5.7 band
<u>Pseudomonas</u>	:	<u>cruciviae</u>	:	4	:	1
	:	<u>desmolyticum</u>	:	2	:	1
	:	<u>eisenbergii</u>	:	3	:	1 (weak)
	:	<u>reptilivora</u>	:	8	:	3 (weak)
<u>Bacillus</u>	:	<u>licheniformis</u>	:	4	:	1
	:	<u>megaterium</u>	:	29	:	9
	:	<u>subtilis</u>	:	15	:	1

Table 1

Summary of the results of the analysis of the data from the study of the effect of the treatment on the outcome.

Treatment Group	Control Group	Treatment Group	Outcome
Group 1	Group 2	Group 3	Outcome 1
Group 4	Group 5	Group 6	Outcome 2
Group 7	Group 8	Group 9	Outcome 3
Group 10	Group 11	Group 12	Outcome 4

Table 3

NUMBER AND FREQUENCY OF OCCURRENCE OF STRAINS WITH 5.7 MICRON BAND

Genus	Strains		
	Total no.	No. with	Percent with
		5.7 μ band	5.7 μ band

A. Distribution of strains of genera having 5.7 micron bands

<u>Bacillus</u>	109	24	22
<u>Mycoplana</u>	2	2	100
<u>Nocardia</u>	4	1	25
<u>Pseudomonas</u>	139	10	7
<u>Rhodospirillum</u>	2	2	100
<u>Spirillum</u>	2	1	50
<u>Vibrio</u>	6	1	17

B. Species for which all strains examined had 5.7 micron bands

<u>Genus</u>	<u>Species</u>	<u>No. of strains</u>
<u>Bacillus</u>	<u>cereus</u>	12
<u>Mycoplana</u>	<u>dimorpha</u>	1
<u>Nocardia</u>	<u>rubra</u>	1
<u>Pseudomonas</u>	<u>cepacia</u>	1
<u>Pseudomonas</u>	<u>suis</u>	1
<u>Rhodospirillum</u>	<u>rubrum</u>	2
<u>Spirillum</u>	<u>virginianum</u>	1
<u>Vibrio</u>	<u>rubicundus</u>	1

Table 4

DISTRIBUTION OF RANGE OF TRANSMISSION DIFFERENCES AT
8.1 MICRONS RELATIVE TO 7.2 MICRONS
(i.e., $T_{8.1}-T_{7.2}$)

<u>Pseudomonas</u>			:	<u>Bacillus</u>		
Extreme differences	: Number of strains	: Percentage of strains		Extreme differences	: Number of strains	: Percentage of strains
0	4	3.1	:	0	8	10.0
1	41	31.6	:	1	21	26.3
2	30	23.1	:	2	15	18.8
3	19	14.6	:	3	11	13.8
4	14	10.8	:	4	9	11.3
5	9	6.9	:	5	4	5.0
6	3	2.3	:	6	7	8.9
7	4	3.1	:	7	2	2.5
8	2	1.5	:	8		
9	1	0.8	:	9	1	1.2
10	2	1.5	:	10		
11			:	11	1	1.2
12			:	12		
13	1	0.8	:	13		
			:	14	1	1.2
			:			
			:			

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SOLVENT		SOLUTE		CONCENTRATION		TEMPERATURE	
NAME	FORMULA	NAME	FORMULA	Wt. %	MOL. %	°C.	°F.
Water	H ₂ O	Sodium Chloride	NaCl	0.1	0.0018	25	77
Water	H ₂ O	Sodium Chloride	NaCl	0.5	0.0090	25	77
Water	H ₂ O	Sodium Chloride	NaCl	1.0	0.0180	25	77
Water	H ₂ O	Sodium Chloride	NaCl	2.0	0.0360	25	77
Water	H ₂ O	Sodium Chloride	NaCl	5.0	0.0900	25	77
Water	H ₂ O	Sodium Chloride	NaCl	10.0	0.1800	25	77
Water	H ₂ O	Sodium Chloride	NaCl	20.0	0.3600	25	77
Water	H ₂ O	Sodium Chloride	NaCl	50.0	0.9000	25	77
Water	H ₂ O	Sodium Chloride	NaCl	100.0	1.8000	25	77

Table 5

EVALUATION OF IMPROVEMENT OF DATA BY METHOD OF READING
TRANSMISSION WAVELENGTHS

Line	Transmission values determined from	Band positions (microns)									
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	
1	Thin section - as read	(37)	(25)	65	60	63	50	67	51	72	
2	Thin section - corrected	(28)	(18)	57	49	54	39	60	40	66	
3	Standard thickness	(29)	(18)	58	52	55	41	60	42	65	
4	Thick section - corrected	30	(16)	61	55	58	41	64	43	67	
5	Thick section - as read	16	(11)	44	37	40	25	46	26	50	

Table 6

DISTRIBUTION OF SPECTRA BY GENUS, SPECIES, AND STRAIN USED
IN STATISTICAL STUDY

Genus	No. of species	No. of strains	No. of curves
<u>Pseudomonas</u>	26	119	516
<u>Bacillus</u>	15	75	290
<u>Acetobacter</u>	18	27	66
<u>Xanthomonas</u>	11	11	66
<u>Micrococcus</u>	5	7	34
<u>Corynebacterium</u>	5	6	19
<u>Proteus</u>	5	6	31
<u>Aeromonas</u>	3	5	12
<u>Agrobacterium</u>	3	5	9
<u>Vibrio</u>	5	5	27
<u>Aerobacter</u>	2	4	11
<u>Nocardia</u>	4	4	18
<u>Achromobacter</u>	2	3	7
<u>Bacterium</u>	2	3	6
<u>Erwinia</u>	2	3	12
<u>Flavobacterium</u>	3	3	9
<u>Sarcina</u>	3	3	19
<u>Streptomyces</u>	3	3	9
<u>Alcaligenes</u>	2	2	6
<u>Cellulomonas</u>	2	2	4
<u>Escherichia</u>	1	2	10
<u>Serratia</u>	1	2	18
<u>Arthrobacter</u>	1	1	3
<u>Azotobacter</u>	1	1	2
<u>Brucella</u>	1	1	2
<u>Chromobacterium</u>	1	1	4
<u>Cytophaga</u>	1	1	3
<u>Mycobacterium</u>	1	1	6
<u>Mycoplana</u>	1	1	5
<u>Neisseria</u>	1	1	2
<u>Spirillum</u>	1	1	6
Total - 31	133	310	1,232

Table 7

DISTRIBUTION OF STRAINS BY SPECIES USED IN STATISTICAL STUDY

Genus	No. of strains per species										Total species
	1	2	3	4	5	7	14	20	59		
	No. of species										
<u>Pseudomonas</u>	9	8	3	1	3	1			1	26	
<u>Bacillus</u>	1	3	5	5			1	1★		16	
<u>Acetobacter</u>	9	9								18	
<u>Xanthomonas</u>	11									11	
<u>Micrococcus</u>	4		1							5	
<u>Corynebacterium</u>	4	1								5	
<u>Proteus</u>	4	1								5	
<u>Aeromonas</u>	1	2								3	
<u>Agrobacterium</u>	1	2								3	
<u>Vibrio</u>	5									5	
<u>Aerobacter</u>		2								2	
<u>Nocardia</u>	4									4	
<u>Achromobacter</u>	1	1								2	
<u>Bacterium</u>	1	1								2	
<u>Erwinia</u>	1	1								2	
<u>Flavobacterium</u>	3									3	
<u>Sarcina</u>	3									3	
<u>Streptomyces</u>	3									3	
<u>Alcaligenes</u>	2									2	
<u>Cellulomonas</u>	2									2	
<u>Escherichia</u>		1								1	
<u>Serratia</u>		1								1	
<u>Arthrobacter</u>	1									1	
<u>Azotobacter</u>	1									1	
<u>Brucella</u>	1									1	
<u>Chromobacterium</u>	1									1	
<u>Cytophaga</u>	1									1	
<u>Mycobacterium</u>	1									1	
<u>Mycoplana</u>	1									1	
<u>Neisseria</u>	1									1	
<u>Spirillum</u>	1									1	
Total species	78	33	9	6	3	1	1	1	1	133	
Total strains	78	66	27	24	15	7	14	20	59	310	

[★] B. megaterium has been decreased by removing strains having 5.7-micron band complex.

Table 8 (Page 1)

TRANSMISSION VALUES (IN CENTIMICRONS) AT SELECTED BAND MAXIMA AND MINIMA (COLUMN HEADINGS IN MICRONS) FOR EACH CURVE OF EACH STRAIN

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Acetobacter aceti B578</u>									
2389	1012	997	1034	1012	1012	1006	1018	1002	1030
2390	1014	998	1037	1015	1015	1009	1020	1000	1033
2391	1012	998	1035	1015	1014	1008	1020	1002	1034
2458	1005	991	1030	1010	1006	995	1014	997	1027
2459	1004	990	1032	1011	1010	1000	1014	996	1029
<u>Acetobacter aceti B581</u>									
2166	982	970	1007	989	989	985	1000	987	1013
<u>Acetobacter acetigenum B469</u>									
2417	964	(895)	990	978	982	974	991	969	1014
2418	962	(892)	989	975	980	973	991	967	1000
2419	954	(874)	985	974	978	971	990	969	998
<u>Acetobacter acetosum B468</u>									
2154	962	(905)	994	979	984	975	994	970	1012
2255	962	(885)	989	975	983	974	992	968	1014
<u>Acetobacter acetosum Variety nairobiense B747</u>									
2155	977	(936)	1015	986	990	984	1000	980	1016
2245	978	(943)	1002	985	990	983	997	979	1008
2246	980	(929)	1007	985	992	983	999	978	1009
<u>Acetobacter acidum-mucosum B145</u>									
2143	1018	(988)	1058	1030	1030	1015	1040	1007	1040
<u>Acetobacter acidum-mucosum B1303</u>									
2129	988	970	1032	1000	1001	993	1014	990	1025
2158	996	976	1045	1010	1014	998	1020	990	1024
<u>Acetobacter ascendens B56</u>									
2126	977	(904)	1014	990	992	985	1008	980	1019
2159	971	(938)	1008	986	990	983	1001	979	1016

Table 8 (Page 2)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Acetobacter ascendens B1047</u>									
2157	988	950	1018	994	995	990	1000	989	1015
2237	989	954	1024	993	995	990	1002	988	1014
<u>Acetobacter capsulatum B1225</u>									
2144	989	946	1021	996	998	993	1014	990	1020
<u>Acetobacter gluconicum B64</u>									
2416	970	940	991	983	985	976	992	985	996
<u>Acetobacter gluconicum B471</u>									
2142	960	(903)	996	980	984	975	993	969	999
2229	968	(900)	995	983	988	979	994	968	997
<u>Acetobacter ketogenum B999</u>									
2385	979	(939)	1010	987	990	985	1005	984	1015
2386	980	(937)	1010	990	995	988	1009	981	1016
2387	981	(939)	1013	992	996	987	1011	983	1018
2449	979	(940)	1011	987	990	985	1009	983	1015
2450	978	(938)	1009	987	990	984	1007	982	1015
<u>Acetobacter melanogenum B63</u>									
2102	950	(893)	982	967	976	965	984	954	989
2147	954	(895)	982	967	975	967	986	956	988
<u>Acetobacter mobile B146</u>									
2184	968	(902)	997	979	986	977	995	966	1009
2496	964	(915)	994	982	984	979	995	969	1010
<u>Acetobacter orleanense B55</u>									
2130	997	909	1019	988	997	986	1017	979	1028
2148	984	(924)	1032	1013	1017	995	1025	981	1037
2183	977	(916)	1023	990	1010	987	1020	978	1030
<u>Acetobacter oxydans B147</u>									
2100	985	955	1030	995	1000	990	1019	991	1030
2156	982	941	1025	996	999	990	1016	990	1029

Table 8 (Page 3)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Acetobacter pasteurianum B752</u>									
2187	944	(879)	987	975	980	970	988	962	996
2240	943	(891)	985	972	979	966	986	960	995
2241	949	(880)	985	974	979	967	986	960	993
<u>Acetobacter rancens B65</u>									
2180	995	974	1036	1011	1015	1004	1023	998	1039
2251	996	973	1028	1008	1013	997	1018	995	1028
2253	993	972	1025	1001	1009	997	1016	995	1030
<u>Acetobacter rancens B754</u>									
2216	990	968	1022	995	1000	991	1009	990	1022
2217	994	970	1034	1009	1011	998	1018	994	1025
2257	999	975	1030	1012	1015	1003	1019	1000	1030
<u>Acetobacter suboxydans B72</u>									
2167	986	951	1033	996	998	990	1019	990	1029
2239	993	961	1047	1009	1012	996	1031	994	1040
<u>Acetobacter suboxydans B177</u>									
2249	975	(929)	1015	988	992	984	1002	979	1016
2250	971	(921)	998	983	986	980	995	976	1008
<u>Acetobacter turbidans B570</u>									
2171	960	(898)	993	977	983	976	1015	965	1021
2231	969	(900)	1015	980	990	978	1018	966	1022
<u>Acetobacter turbidans B1026</u>									
2218	990	970	1018	994	997	992	1012	989	1024
2219	995	973	1033	1004	1012	996	1021	990	1033
2234	990	970	1024	997	1003	993	1013	990	1032
2235	995	974	1035	1004	1012	997	1022	992	1037
<u>Acetobacter xylinoides B1034</u>									
2460	989	963	1015	998	1002	993	1012	989	1016

Table 8 (Page 4)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Acetobacter xylinum B42</u>									
2185	1011	997	1034	1015	1015	1010	1021	1009	1036
2186	1022	1014	1053	1025	1019	1013	1026	1015	1032
2242	1000	994	1027	1009	1006	995	1015	1002	1030
2243	1011	994	1034	1015	1014	1007	1020	1001	1030
2244	1011	997	1034	1015	1014	1008	1019	1001	1032
<u>Acetobacter xylinum B43</u>									
2586	(908)	(861)	968	953	964	937	974	935	985
2588	(912)	(873)	973	962	969	947	979	938	987
<u>Achromobacter ammoniagenes B1323</u>									
2109	955	(908)	986	973	979	972	987	968	990
2135	964	(882)	992	977	982	975	990	972	993
<u>Achromobacter lacticum B551</u>									
2178	975	(942)	1014	988	991	986	1012	980	1020
2221	982	(936)	1020	992	995	990	1015	983	1024
2222	985	(923)	1024	1002	1015	993	1020	985	1034
<u>Achromobacter lacticum B552</u>									
2125	930	(906)	980	964	969	957	981	952	984
2152	934	(887)	984	969	973	963	984	953	987
<u>Aerobacter aerogenes B199</u>									
699	945	(905)	990	979	983	969	992	973	1012
700	939	(881)	988	977	981	969	990	970	1010
701	945	(937)	990	980	983	973	991	977	1012
2119	973	(934)	1006	989	994	984	1007	984	1016
2124	973	(946)	1008	989	995	983	1007	981	1015
<u>Aerobacter aerogenes B562</u>									
2108	974	(958)	1018	986	989	981	1011	985	1024
2139	975	(949)	1014	987	989	980	1006	984	1022
<u>Aerobacter cloacae B126</u>									
2117	984	(956)	1011	998	1000	991	1006	992	1024
2133	983	(950)	1006	994	998	988	1002	988	1013

Table 8 (Page 5)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Aerobacter cloacae B169</u>									
2127	944	(898)	986	975	979	969	985	963	993
2160	943	(888)	993	982	984	974	994	965	1010
<u>Aeromonas hydrophila B909</u>									
251	934	(915)	984	974	981	961	988	956	988
252	(939)	(892)	981	969	979	958	986	956	988
312	928	(914)	979	966	976	958	985	955	984
<u>Aeromonas hydrophila B910</u>									
282	934	(907)	985	977	984	966	992	959	992
283	932	(899)	984	974	980	962	988	957	989
284	932	(886)	987	975	985	966	994	964	994
<u>Micrococcus species B911</u>									
311	938	(909)	986	976	980	972	991	963	999
319	951	(903)	989	979	984	974	995	963	1002
<u>Aeromonas ichthyosmia B926</u>									
289	(925)	(891)	972	959	970	950	983	945	991
290	(920)	(874)	970	955	966	949	980	944	988
<u>Aeromonas punctata B914</u>									
749	(919)	(878)	955	944	950	920	967	924	978
750	(917)	(875)	960	945	954	926	971	927	981
<u>Aeromonas Species B538</u>									
206	936	(904)	974	964	972	960	984	944	987
208	930	(904)	972	961	971	955	982	940	987
216	946	(918)	979	969	975	965	985	954	985
217	930	(905)	974	962	973	955	982	941	988
<u>Agrobacterium radiobacter B164</u>									
2114	960	(934)	1002	988	990	979	1000	985	1008
2138	958	(940)	999	985	988	971	999	983	1008
<u>Agrobacterium radiobacter B181</u>									
2111	956	(919)	994	982	987	973	998	967	1005
2140	944	(909)	988	971	979	962	990	959	998

Table 1: Summary of Data									
Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9

Table 2: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 3: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 4: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 5: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 6: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 7: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 8: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 9: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 10: Detailed Data

Year	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
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Table 8 (Page 6)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Agrobacterium rhizogenes B193</u>									
2146	940	(881)	994	985	987	976	994	968	1010
<u>Agrobacterium tumefaciens B36</u>									
2107	969	(943)	1006	991	995	984	1004	985	1009
2123	960	(938)	1000	985	988	977	999	984	1004
<u>Agrobacterium tumefaciens B37</u>									
2128	940	(909)	991	977	983	966	993	971	1001
2151	954	(918)	1000	984	989	976	1000	975	1007
<u>Alcaligenes faecalis B170</u>									
2110	934	(881)	974	962	973	960	980	144	983
2122	(927)	(871)	969	956	965	953	973	933	978
<u>Alcaligenes viscosus B182</u>									
538	939	(939)	985	974	978	966	987	978	998
745	937	(929)	985	973	975	965	986	974	1000
2116	972	943	995	988	990	983	997	988	1008
2141	986	968	1021	995	998	990	1016	997	1021
<u>Arthrobacter citreus B1258</u>									
704	975	(954)	1015	1009	1010	984	1014	1009	1026
788	967	(945)	1010	983	986	978	1010	1008	1024
789	970	(953)	1013	986	1008	979	1012	1009	1027
<u>Azotobacter chroococcum B488</u>									
2112	(950)	(949)	972	966	965	(956)	975	965	987
2134	(951)	(949)	974	968	967	(957)	979	967	988
<u>Aeromonas salmonicida B1465</u>									
566	(9013)	(840)	973	954	969	936	978	937	987
<u>Bacterium stewartii B28</u>									
2150	(933)	(888)	982	970	979	959	987	955	995
2194	933	(889)	992	983	983	960	994	974	1007
2195	(933)	(900)	992	981	981	952	993	975	1008

Table 8 (Page 7)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacterium stewartii B158</u>									
2131	940	(898)	991	984	985	972	993	985	1005
2153	936	(900)	990	980	982	960	991	972	1000
<u>Brucella bronchiseptica B140</u>									
695	(922)	(866)	966	949	963	947	974	937	982
768	(929)	(886)	958	943	957	939	971	929	979
<u>Cellulomonas biazotea B401</u>									
2104	957	(909)	1016	981	987	975	1016	974	1038
2113	939	(923)	1015	982	984	973	1015	973	1029
<u>Cellulomonas udum B404</u>									
2118	978	971	1018	1005	1005	984	1016	1000	1025
2132	982	974	1018	1009	1009	988	1015	1008	1022
<u>Chromobacterium violaceum B1020</u>									
387	934	(911)	969	957	969	955	979	949	980
388	939	(912)	969	959	970	955	980	950	982
501	928	(894)	965	955	964	950	974	943	981
502	927	(985)	964	954	963	949	970	943	978
<u>Corynebacterium fascians B190</u>									
2175	(944)	(886)	1006	980	990	971	1000	980	1042
2199	973	(940)	1019	996	1012	985	1018	989	1054
<u>Corynebacterium fimi B402</u>									
2173	959	(928)	1000	985	987	978	1000	978	1036
2227	960	926	(995)	985	988	975	994	974	924
<u>Corynebacterium fimi B403</u>									
2165	974	928	1033	1016	1020	988	1028	989	1041
2226	975	(949)	1035	1019	1023	988	1031	984	1040
<u>Corynebacterium flaccumfaciens B729</u>									
2193	985	965	1033	1016	1018	1011	1024	1008	1035
2206	989	973	1030	1017	1018	1013	1023	1013	1033
2207	990	973	1032	1018	1020	1013	1024	1013	1035

Table 8 (Page 8)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Corynebacterium michiganense B33</u>									
2181	986	935	1028	1009	1012	996	1015	992	1035
2203	981	930	1030	1010	1014	991	1018	989	1037
<u>Corynebacterium xerosa B1379</u>									
411	(934)	(907)	993	974	984	952	992	968	1035
412	(925)	(889)	995	977	985	955	994	967	1035
413	(932)	(875)	995	975	984	959	994	970	1033
542	(918)	(885)	980	966	976	947	987	952	1036
543	(912)	(879)	978	962	972	944	984	948	1034
2191	(930)	(898)	985	967	978	953	988	955	1009
2210	(929)	(872)	986	965	976	954	989	956	1011
2211	(933)	(878)	994	973	981	956	995	960	1015
<u>Cytophaga hutchinsoniae B216</u>									
550	925	(905)	984	970	974	963	987	967	1015
551	(944)	(899)	984	970	974	961	984	967	1013
744	925	(899)	985	971	974	964	986	968	1013
<u>Erwinia amylovora B127</u>									
2738	(929)	(846)	981	969	975	960	985	952	993
2739	(928)	(850)	979	970	975	960	984	978	993
2740	(930)	(869)	977	970	974	959	982	956	990
2792	933	(868)	987	976	982	967	990	960	1006
2793	(923)	(867)	977	968	974	954	984	953	992
2814	(929)	(875)	979	969	974	954	985	953	993
<u>Erwinia amylovora B405</u>									
2190	967	(905)	994	981	986	978	992	955	990
2214	958	(910)	985	975	981	973	986	950	985
2215	959	901	987	975	980	973	988	950	988
<u>Erwinia carotovora B422</u>									
553	(935)	(914)	979	960	969	(952)	982	975	998
784	(914)	(928)	971	955	965	933	977	942	989
2712	(941)	(918)	977	970	975	954	985	950	995
<u>Escherichia coli B210</u>									
2182	980	(940)	1012	998	1004	990	1012	989	1018
2224	955	(906)	999	985	989	979	1000	976	1009
2225	958	(887)	1003	987	993	981	1003	978	1012

Table 8 (Page 9)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Escherichia coli B281</u>									
705	(935)	(857)	977	964	970	929	983	947	995
706	(939)	(874)	979	968	973	932	984	957	1000
776	923	(903)	984	975	979	962	989	969	1005
777	924	(885)	984	975	978	961	988	967	1004
2192	982	(945)	1018	999	1009	989	1015	985	1024
2204	970	(948)	1001	987	990	980	1005	979	1015
2205	975	(934)	1008	990	994	983	1008	980	1016
<u>Flavobacterium auranticum B184</u>									
2177	976	(916)	1042	1004	1013	989	1036	987	1060
2212	964	(9012)	1012	990	995	979	1008	982	1039
2213B	974	(930)	1018	995	1005	987	1012	986	943
<u>Flavobacterium devorans B54</u>									
2174	(920)	(870)	969	950	962	943	971	944	981
2208	(928)	(888)	973	954	962	950	975	949	980
2209	(929)	(884)	970	952	960	942	974	947	981
<u>Flavobacterium sulfurium B185</u>									
2176	947	(914)	982	972	978	964	985	962	990
2196	957	(935)	992	984	987	973	990	982	1012
2197	(944)	(921)	983	970	973	962	985	968	991
<u>Micrococcus conglomeratus B635</u>									
2757	(949)	(928)	982	973	977	947	986	935	998
2758	(941)	(900)	983	974	979	954	987	938	999
2759	(917)	(863)	984	974	979	952	986	948	1000
2800	(940)	(912)	980	972	976	950	985	947	996
2801	(945)	(923)	981	973	978	956	985	949	995
2802	(921)	(865)	982	973	978	952	986	943	998
<u>Micrococcus lysodeikticus B287</u>									
702	(945)	(930)	1004	974	980	964	992	979	1022
703	(946)	(927)	1008	975	982	965	1003	980	1021
2299	(948)	(939)	1012	985	991	970	1009	978	1028
2300	(943)	(922)	1013	985	993	969	1008	978	1025
2301	(952)	(938)	1011	985	992	970	1009	976	1029
2363	(952)	(925)	1016	990	995	976	1014	987	1038
2364	(949)	(937)	1014	986	993	971	1010	978	1030
2365	(947)	(924)	1010	983	989	969	1008	978	1030

Year	Month	Day	Time	Place	Remarks
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1900

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1900	Jan	3	10:00	1000	1000
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1900	Jan	7	10:00	1000	1000
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1900	Jan	9	10:00	1000	1000
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1900

1900	Jan	11	10:00	1000	1000
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1900	Jan	13	10:00	1000	1000
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1900	Jan	20	10:00	1000	1000

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1900

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1900	Feb	19	10:00	1000	1000

1900

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1900	Mar	6	10:00	1000	1000
1900	Mar	7	10:00	1000	1000
1900	Mar	8	10:00	1000	1000
1900	Mar	9	10:00	1000	1000

Table 8 (Page 10)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Micrococcus pyogenes B1317</u>									
2502	954	(920)	1002	995	995	973	1008	963	1006
2503	(945)	(926)	989	983	985	967	991	955	995
2517	(925)	(880)	980	969	974	948	985	945	991
2518	(938)	(895)	985	975	980	955	988	949	993
2519	(933)	(893)	982	973	976	953	985	950	994
<u>Micrococcus pyogenes B1318</u>									
2305	(948)	(924)	989	978	983	963	990	954	995
2306	(944)	(903)	991	981	986	966	993	957	998
2307	940	(906)	994	983	988	969	995	957	1000
2369	944	(920)	988	978	984	963	991	955	995
2370	942	(904)	989	979	983	964	991	952	995
2371	946	(910)	990	983	987	968	993	959	1000
<u>Micrococcus pyogenes Variety aureus B1317B</u>									
162	(939)	(915)	979	970	975	953	987	949	991
<u>Micrococcus roseus B245</u>									
2312	1015	1010	1034	1020	1020	1015	1020	1019	1033
2313	1016	1009	1031	1020	1020	1015	1020	1019	1033
2359	1015	1008	1029	1019	1019	1015	1020	1018	1030
<u>Micrococcus subcitreus B186</u>									
2392	(953)	(943)	1005	983	984	967	994	982	1018
2393	(938)	(919)	1000	983	985	970	993	983	1020
2395	(936)	(914)	995	981	983	968	991	980	1018
2446	(937)	(911)	1013	987	987	973	1007	983	1020
2448	(929)	(904)	1007	983	983	969	994	980	1019
<u>Micrococcus species B916</u>									
3251	966	(921)	992	984	991	978	998	967	1000
3252	958	(923)	992	984	990	975	998	968	1004
3269	966	(935)	993	984	990	977	998	966	1000
3270	963	(919)	990	983	989	977	996	965	999
3932	970	(954)	997	989	995	980	1002	973	998
3933	970	(952)	997	988	994	981	1001	970	997

Table 8 (Page 11)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Mycobacterium smegmatis B612</u>									
2308	940	(886)	987	973	982	962	987	958	989
2309	951	(891)	991	977	985	970	991	959	991
2310	944	(890)	985	972	980	963	985	955	987
2356	935	(907)	980	966	978	960	985	955	986
2357	937	(893)	980	967	975	958	984	955	985
2358	940	(884)	983	969	979	963	987	956	989
<u>Pseudomonas cruciviae B1090</u>									
659	(910)	(864)	961	930	956	(933)	972	929	984
660	(912)	(857)	963	930	955	(932)	973	933	984
1198	(927)	(889)	970	951	962	927	974	932	985
1199	(942)	(873)	1017	978	988	965	1015	958	1016
1200	(930)	(885)	975	956	969	932	979	939	991
<u>Neisseria perflava B1458</u>									
395	(898)	(842)	945	930	947	(929)	961	(930)	973
396	(902)	(859)	945	932	948	(930)	963	(925)	978
<u>Nocardia coeliaca B1365</u>									
2314	(946)	(929)	980	970	977	955	985	959	998
2315	(939)	(913)	983	973	978	955	986	957	997
2316	(929)	(900)	981	970	976	954	983	955	995
2353	(935)	(910)	980	969	974	948	983	958	995
2354	(929)	(905)	979	967	974	947	984	957	994
2355	(915)	(866)	978	968	975	(945)	983	959	998
<u>Nocardia erythropolis B1532</u>									
2774	930	(935)	997	975	984	970	1009	975	1033
2775	950	(905)	1010	977	988	973	1010	975	1033
<u>Nocardia globerula B1306</u>									
2741	(938)	(920)	985	971	982	957	992	957	1020
2742	(925)	(879)	984	969	979	955	988	957	1016
2744	(935)	(892)	986	971	983	958	992	960	1019
2794	(931)	(913)	985	971	983	958	994	960	1040
2795	(937)	(922)	983	970	979	950	988	954	1019
2796	(930)	(894)	981	968	979	954	990	955	1020
<u>Nocardia polychromogenes B1531</u>									
2776	965	(950)	1020	994	1010	984	1018	994	1045
2777	974	(935)	1022	996	1010	988	1017	995	1042
2778	982	(932)	1034	1007	1017	995	1025	1005	1050

Table 8 (Page 12)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Proteus ammoniae B420</u>									
2379	(929)	(852)	985	973	980	954	992	951	1009
2380	(931)	(865)	983	974	981	957	989	952	1012
2381	(918)	(857)	976	963	969	947	985	946	993
2424	(923)	(885)	974	958	966	945	982	944	990
2425	(919)	(873)	975	960	968	945	983	945	992
2426	(920)	(851)	979	965	974	949	985	947	995
<u>Proteus anindologenes B418</u>									
2410	(929)	(903)	975	960	964	938	979	947	995
2411	(921)	(868)	975	962	968	945	979	947	994
2427	(930)	(884)	983	970	975	958	985	954	1000
2429	(936)	(888)	982	972	976	955	987	952	1000
2430	(930)	(870)	982	971	977	958	986	955	1010
<u>Proteus mirabilis B400</u>									
2406	(914)	(867)	965	948	956	(934)	972	931	985
2408	(897)	(824)	968	952	960	930	977	936	987
2455	(914)	(870)	968	950	957	930	975	930	985
2456	(929)	(922)	967	949	955	(944)	974	930	986
2457	(922)	(886)	968	954	958	931	975	934	987
<u>Proteus morganii B540</u>									
2382	(933)	(884)	974	964	970	953	981	937	989
2383	(923)	(880)	968	959	966	946	977	938	988
2384	(930)	(886)	970	959	967	974	977	936	986
2431	(921)	(874)	969	958	966	946	975	933	986
2432	(924)	(849)	972	963	969	950	979	938	988
2433	(928)	(886)	972	960	967	949	980	935	989
<u>Proteus vulgaris B123</u>									
2399	(944)	(892)	980	972	976	960	985	942	993
2400	933	(866)	984	975	979	965	989	949	997
2401	(942)	(890)	980	972	977	963	987	950	995
2440	(938)	(892)	978	969	973	958	983	945	994
2441	(946)	(895)	982	973	977	963	986	950	994
2442	(948)	(918)	981	970	973	960	985	947	993
<u>Proteus vulgaris B415</u>									
2514	(925)	(886)	970	954	962	931	979	934	992
2515	(919)	(830)	977	960	968	937	980	933	988
2516	(918)	(827)	977	960	970	946	983	937	993

Table 8 (Page 13)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Sarcina flava B1262</u>									
2376	(968)	(959)	1015	995	999	980	1011	1006	1002
2377	(963)	(953)	1015	999	1004	980	1012	1007	1023
2378	(962)	(946)	1016	1000	1003	981	1013	1008	1024
2421	(960)	(952)	1011	991	993	981	1009	1005	1020
2422	(966)	(956)	1013	994	997	981	1010	1007	1022
2423	(960)	(945)	1009	989	992	979	1007	1005	1020
<u>Sarcina lutea B1018</u>									
382	(962)	(950)	1016	987	1012	977	1015	1012	1034
590	965	(954)	1013	1004	1006	978	1010	1004	1024
591	967	(955)	1013	1004	1008	978	1010	1006	1025
592	939	(955)	1012	1002	1005	978	1010	1005	1025
2396	962	(965)	1015	991	1009	980	1013	1010	1029
2397	968	(955)	1015	989	1007	979	1014	1010	1028
2443	967	(949)	1018	993	1010	980	1015	1011	1032
2444	963	(956)	1016	990	1008	980	1014	1009	1029
2445	966	(952)	1015	992	1008	979	1012	1009	1027
<u>Sarcina ureae B286</u>									
693	(915)	(888)	961	926	945	(938)	970	948	985
694	(919)	(893)	965	928	947	(942)	971	948	986
782	(935)	(923)	965	(962)	945	(954)	973	952	987
783	(936)	(916)	962	(957)	945	(950)	970	946	983
<u>Serratia marcescens B284</u>									
14A	(955)	(914)	990	974	983	966	991	960	1000
389	(911)	(866)	953	939	948	930	970	931	981
390	(909)	(859)	945	932	942	(926)	968	932	979
409	(922)	(885)	971	954	965	946	977	935	984
410	(916)	(867)	965	948	960	943	973	933	983
588	(913)	(863)	961	944	958	937	968	929	976
589	(917)	(869)	966	951	962	943	974	931	982
2402	932	(886)	981	970	977	959	985	941	990
2403	931	(875)	979	969	978	955	984	942	989
2404	(930)	(884)	975	967	972	956	981	942	990
2437	931	(884)	983	971	976	958	986	940	990
2438	(928)	(873)	977	966	974	955	984	943	990
2439	929	(878)	979	970	975	957	985	945	993

Table 8 (Page 13)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Sarcina flava B1262</u>									
2376	(968)	(959)	1015	995	999	980	1011	1006	1002
2377	(963)	(953)	1015	999	1004	980	1012	1007	1023
2378	(962)	(946)	1016	1000	1003	981	1013	1008	1024
2421	(960)	(952)	1011	991	993	981	1009	1005	1020
2422	(966)	(956)	1013	994	997	981	1010	1007	1022
2423	(960)	(945)	1009	989	992	979	1007	1005	1020
<u>Sarcina lutea B1018</u>									
382	(962)	(950)	1016	987	1012	977	1015	1012	1034
590	965	(954)	1013	1004	1006	978	1010	1004	1024
591	967	(955)	1013	1004	1008	978	1010	1006	1025
592	939	(955)	1012	1002	1005	978	1010	1005	1025
2396	962	(965)	1015	991	1009	980	1013	1010	1029
2397	968	(955)	1015	989	1007	979	1014	1010	1028
2443	967	(949)	1018	993	1010	980	1015	1011	1032
2444	963	(956)	1016	990	1008	980	1014	1009	1029
2445	966	(952)	1015	992	1008	979	1012	1009	1027
<u>Sarcina ureae B286</u>									
693	(915)	(888)	961	926	945	(938)	970	948	985
694	(919)	(893)	965	928	947	(942)	971	948	986
782	(935)	(923)	965	(962)	945	(954)	973	952	987
783	(936)	(916)	962	(957)	945	(950)	970	946	983
<u>Serratia marcescens B284</u>									
14A	(955)	(914)	990	974	983	966	991	960	1000
389	(911)	(866)	953	939	948	930	970	931	981
390	(909)	(859)	945	932	942	(926)	968	932	979
409	(922)	(885)	971	954	965	946	977	935	984
410	(916)	(867)	965	948	960	943	973	933	983
588	(913)	(863)	961	944	958	937	968	929	976
589	(917)	(869)	966	951	962	943	974	931	982
2402	932	(886)	981	970	977	959	985	941	990
2403	931	(875)	979	969	978	955	984	942	989
2404	(930)	(884)	975	967	972	956	981	942	990
2437	931	(884)	983	971	976	958	986	940	990
2438	(928)	(873)	977	966	974	955	984	943	990
2439	929	(878)	979	970	975	957	985	945	993

Table 8 (Page 14)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Serratia marcescens B1481</u>									
2412	(936)	(869)	974	962	969	950	978	944	989
2413	(932)	(878)	979	964	972	955	983	947	994
2414	(940)	(883)	981	966	975	960	985	949	994
2452	(942)	(889)	983	967	974	961	985	955	995
2454	(941)	(878)	987	970	980	963	988	954	994
<u>Spirillum serpens B331</u>									
2373	(942)	(933)	979	970	977	958	984	954	994
2374	(934)	(913)	985	975	980	958	988	962	1000
2375	(940)	(916)	982	972	979	960	985	958	995
2434	(926)	(905)	982	974	977	953	987	962	1002
2435	935	(915)	997	985	987	970	1000	969	1016
2436	(935)	(899)	984	975	979	959	986	959	998
<u>Streptomyces alvi B1521</u>									
2809	(923)	(865)	975	962	973	949	984	963	997
2810	(948)	(874)	991	975	989	967	995	970	1005
2812	(923)	(852)	990	973	987	961	993	973	1001
<u>Streptomyces bikiniensis B1049</u>									
2610	(954)	(924)	993	978	982	972	995	987	1029
2611	(948)	(913)	994	979	983	973	1007	988	1028
2612	(957)	(931)	1010	984	987	978	1013	992	1028
<u>Streptomyces griseus B1078</u>									
2644	948	(945)	1004	990	994	985	1008	995	1020
2645	964	(947)	1014	997	1001	990	1015	999	1031
2646	947	(959)	1004	991	994	985	1008	994	1019
<u>Vibrio cyclosites B1022</u>									
2585	(925)	(857)	986	966	975	953	984	953	993
2732	(924)	(883)	980	965	975	949	983	954	990
2733	(923)	(880)	979	960	973	948	980	948	988
2734	(928)	(896)	976	957	970	942	977	942	984
<u>Vibrio neocistes B1037</u>									
2566	(923)	(885)	982	973	977	950	986	959	1002
2567	(937)	(905)	984	974	980	955	988	960	999
2622	(930)	(909)	984	973	978	953	988	955	1000
2623	(928)	(902)	984	974	979	955	988	956	998
2624	(926)	(896)	983	973	978	953	987	956	999

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Vibrio percolans B1055</u>									
2578	(943)	(935)	968	957	965	955	977	933	983
2579	(940)	(909)	974	958	972	955	979	937	984
2580	(940)	(884)	976	962	974	957	983	942	987
2640	(934)	(913)	970	957	970	956	982	945	984
2641	(938)	(898)	970	957	969	955	978	939	983
2642	(938)	(896)	973	959	972	956	980	939	984
<u>Vibrio phosphorescens B144</u>									
2563	(905)	(855)	979	963	974	930	934	951	1003
2564	(920)	(865)	979	968	976	934	985	950	1004
2565	(933)	(883)	980	968	978	934	985	956	1005
2609	(923)	(898)	972	960	969	938	979	944	990
2613	(908)	(841)	970	958	969	935	977	941	989
2614	(910)	(833)	976	963	974	944	981	949	992
<u>Vibrio tyrongenes B242</u>									
2593	(929)	(883)	978	959	972	954	984	937	989
2594	(928)	(879)	982	962	975	955	988	937	991
2595	(936)	(901)	977	958	970	954	983	936	987
2628	(937)	(906)	975	959	969	953	981	939	986
2629	(932)	(897)	974	957	966	975	980	938	986
2630	(928)	(866)	974	956	968	951	979	940	985
<u>Xanthomonas begoniae B34</u>									
2569	944	(945)	998	985	986	975	995	985	1019
2570	963	(960)	1009	988	989	979	1000	988	1024
2571	(966)	(955)	999	986	987	976	996	988	1024
2631	964	(964)	1015	990	991	980	1004	988	1028
2632	957	(959)	1011	988	989	979	1002	987	1024
2633	951	(957)	1000	986	987	976	995	987	1023
<u>Xanthomonas beticola B1092</u>									
2560	948	(939)	991	983	987	974	995	973	1011
2561	954	(919)	993	985	988	975	996	973	1016
2562	956	(938)	993	985	988	977	997	974	1013
2603	953	(926)	992	983	986	975	995	968	1013
2604	945	(924)	990	979	984	970	992	965	1004
2605	950	(913)	991	981	988	973	994	968	1012

Section 1		Section 2		Section 3		Section 4		Section 5	
Item 1	1000	Item 2	2000	Item 3	3000	Item 4	4000	Item 5	5000
Item 6	6000	Item 7	7000	Item 8	8000	Item 9	9000	Item 10	10000
Item 11	11000	Item 12	12000	Item 13	13000	Item 14	14000	Item 15	15000
Item 16	16000	Item 17	17000	Item 18	18000	Item 19	19000	Item 20	20000
Item 21	21000	Item 22	22000	Item 23	23000	Item 24	24000	Item 25	25000
Item 26	26000	Item 27	27000	Item 28	28000	Item 29	29000	Item 30	30000
Item 31	31000	Item 32	32000	Item 33	33000	Item 34	34000	Item 35	35000
Item 36	36000	Item 37	37000	Item 38	38000	Item 39	39000	Item 40	40000
Item 41	41000	Item 42	42000	Item 43	43000	Item 44	44000	Item 45	45000
Item 46	46000	Item 47	47000	Item 48	48000	Item 49	49000	Item 50	50000
Item 51	51000	Item 52	52000	Item 53	53000	Item 54	54000	Item 55	55000
Item 56	56000	Item 57	57000	Item 58	58000	Item 59	59000	Item 60	60000
Item 61	61000	Item 62	62000	Item 63	63000	Item 64	64000	Item 65	65000
Item 66	66000	Item 67	67000	Item 68	68000	Item 69	69000	Item 70	70000
Item 71	71000	Item 72	72000	Item 73	73000	Item 74	74000	Item 75	75000
Item 76	76000	Item 77	77000	Item 78	78000	Item 79	79000	Item 80	80000
Item 81	81000	Item 82	82000	Item 83	83000	Item 84	84000	Item 85	85000
Item 86	86000	Item 87	87000	Item 88	88000	Item 89	89000	Item 90	90000
Item 91	91000	Item 92	92000	Item 93	93000	Item 94	94000	Item 95	95000
Item 96	96000	Item 97	97000	Item 98	98000	Item 99	99000	Item 100	100000

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Xanthomonas campestris B1459</u>									
417	981	974	1014	991	992	984	1011	989	1019
418	981	974	1011	990	991	982	1009	989	1018
599	975	959	1007	985	987	977	995	984	1013
600	975	963	1009	985	988	979	1004	984	1012
601	974	960	1005	986	987	978	996	984	1013
2745	986	981	1015	991	991	986	1012	992	1017
2746	983	980	1010	990	991	983	1000	990	1015
2747	980	975	999	988	989	982	999	990	1015
2798	982	977	1005	991	992	984	1003	991	1016
2799	985	980	1014	993	993	985	1002	990	1015
<u>Xanthomonas carotae B1008</u>									
2556	(942)	(928)	997	978	980	967	994	936	1023
2557	(949)	(940)	992	974	979	967	994	933	1022
2558	(930)	(927)	1019	983	984	973	1018	958	1025
2606	(954)	(944)	989	974	978	969	990	933	1024
2607	(949)	(937)	987	974	976	963	989	(958)	1018
2608	(948)	(922)	989	974	978	964	990	930	1020
<u>Xanthomonas geranii B1011</u>									
2581	983	961	1008	990	993	985	1001	989	1006
2582	985	968	1017	993	995	987	1010	990	1015
2583	984	960	1005	992	993	985	1002	990	1011
2616	984	968	1015	991	993	986	1004	990	1012
2617	984	968	1013	990	992	986	1003	989	1010
2618	984	969	1010	991	992	985	1001	990	1007
<u>Xanthomonas incanae B1012</u>									
2575	978	967	999	990	990	981	998	988	1016
2576	977	960	1000	990	991	982	999	988	1017
2577	985	970	1016	996	998	989	1014	988	1018
2637	985	972	1015	992	994	985	1013	989	1017
2638	982	969	1004	992	993	984	1000	990	1018
2639	986	972	1017	995	996	987	1014	990	1019
<u>Xanthomonas juglandis B1013</u>									
2590	981	975	995	989	989	979	996	993	1004
2591	979	973	997	989	990	980	996	991	1014
2592	983	974	998	990	990	983	998	992	1002
2625	988	978	1018	994	995	988	1014	991	1015
2626	984	971	1015	990	992	987	1012	989	1015
2627	979	964	999	989	990	981	998	986	1004

Table 8 (Page 17)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Xanthomonas malvacearum B215</u>									
2553	954	(929)	993	984	988	974	999	978	1013
2554	962	(944)	999	988	992	980	1007	983	1016
2555	953	(917)	995	985	990	974	999	982	1013
2619	950	(938)	993	980	989	972	998	970	1014
2620	948	(882)	992	981	987	973	996	969	1011
2621	951	(988)	993	984	989	973	1000	970	1014
<u>Xanthomonas phaseoli B1460</u>									
447	928	(909)	974	963	972	955	982	953	989
448	925	(904)	973	960	970	954	980	951	988
449	925	(888)	975	964	972	955	984	956	991
529	(933)	(903)	967	954	965	945	974	950	985
2779	980	964	1010	992	993	985	1004	987	1010
2781	973	957	997	987	988	978	998	985	1002
2785	974	948	994	985	986	980	997	985	1000
<u>Xanthomonas proteamaculans B987</u>									
2764	(928)	(852)	985	969	980	959	988	956	996
2789	(931)	(878)	983	969	978	958	988	955	994
<u>Xanthomonas pruni B1014</u>									
2572	(954)	(925)	1024	986	993	975	1023	964	1039
2573	(947)	(919)	1017	979	983	970	1015	959	1027
2574	(948)	(923)	1015	978	981	969	1014	958	1024
2635	(940)	(920)	1014	977	980	969	1013	954	1023
2636	(948)	(919)	1014	979	983	969	1012	952	1023
<u>Bacillus alvei B383</u>									
3654	942	(913)	986	977	981	970	993	986	996
3711	958	(914)	986	979	984	974	991	987	994
3993	967	935	1009	990	995	980	1009	980	1009
<u>Bacillus alvei B385</u>									
3603	937	(915)	986	973	973	958	987	978	1000
3604	940	(917)	990	986	987	965	991	980	1002
3709	934	(917)	987	974	974	955	989	980	1005
3710	935	(908)	984	981	982	959	987	976	1001
3714	936	(897)	984	973	975	959	987	965	997
3966	(933)	(916)	979	968	971	952	984	969	995
3967	935	(919)	989	972	976	961	990	972	998
4002	932	(917)	995	983	986	962	995	977	1001
4003	938	(928)	1014	990	992	971	1000	984	1015

Table 8 (Page 18)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus alvei B386</u>									
2943	945	(998)	990	979	981	972	994	980	999
2974	(913)	(878)	979	956	965	941	978	954	987
2975	(914)	(892)	970	958	966	942	979	955	988
<u>Bacillus circulans B378</u>									
3574	(917)	(880)	970	956	963	935	975	953	990
3575	(918)	(877)	975	960	966	937	980	954	993
3601	933	(897)	984	971	973	953	984	969	993
3602	933	(909)	985	972	974	956	986	971	993
3631	(913)	(875)	964	954	963	935	974	946	984
3632	(908)	(858)	965	954	963	935	973	946	982
3670	(924)	(888)	972	960	968	948	979	954	989
2671	(925)	(892)	972	963	968	948	979	957	989
<u>Bacillus circulans NRS831</u>									
3041	982	961	1010	995	996	987	1009	982	996
3695	965	(935)	995	986	990	977	997	970	986
<u>Bacillus circulans NRS1136</u>									
2924	939	(917)	988	975	975	959	990	978	997
2925	938	(918)	990	977	977	962	990	978	997
2957	937	(906)	994	984	985	969	996	985	1008
2958	935	(893)	992	981	982	966	993	984	1005
<u>Bacillus coagulans NRST13</u>									
2937	966	(915)	993	984	988	980	998	970	998
2938	974	(923)	1003	988	993	985	1004	974	1000
2951	988	958	1013	997	1000	991	1012	983	996
2952	995	968	1018	1004	1005	995	1014	985	998
<u>Bacillus coagulans NRS795</u>									
3715	970	(943)	1007	995	998	985	1007	978	1008
3744	979	(946)	1018	1005	1009	991	1015	980	1013
3745	967	(930)	1008	995	996	982	1007	977	1007
<u>Bacillus coagulans NRS796</u>									
2939	966	(941)	996	988	992	980	1000	970	1004
2940	965	(944)	996	989	992	979	1001	973	1005
2955	975	(954)	1006	995	996	985	1010	979	1004
2956	972	(950)	1001	991	994	982	1005	976	1002

Table 8 (Page 19)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus firmus NRS855</u>									
3036	969	935	999	988	988	977	1000	984	1000
<u>Bacillus firmus NRS858</u>									
2929	(928)	(901)	983	966	968	950	990	955	1000
2936	(924)	(902)	968	961	964	939	976	953	990
2949	(924)	(900)	971	963	967	948	977	954	991
2969	(931)	(917)	978	970	974	954	981	963	993
2970	(929)	(909)	984	975	979	960	987	967	1011
<u>Bacillus laterosporus NRS314</u>									
3510	(903)	(861)	951	931	950	(925)	961	(932)	974
3511	(910)	(870)	955	939	954	(928)	964	(936)	974
<u>Bacillus laterosporus NRS340</u>									
3717	(907)	(868)	953	937	952	(924)	963	(934)	976
3718	(899)	(857)	949	933	948	(921)	961	(929)	974
3773	939	(899)	983	972	980	958	987	951	985
3774	936	(900)	977	970	975	957	981	952	981
<u>Bacillus laterosporus NRS347</u>									
2963	(917)	(883)	961	950	960	(937)	971	932	979
2964	(919)	(883)	960	950	960	(935)	970	930	978
<u>Bacillus laterosporus NRS590</u>									
2930	(912)	(867)	964	952	962	934	973	937	985
3006	(928)	(893)	973	961	969	949	979	953	984
3007	(927)	(883)	973	963	969	949	980	950	984
<u>Bacillus lentus B396</u>									
3624	930	(898)	985	976	977	965	986	961	990
<u>Bacillus lentus NRS883</u>									
3563	944	(903)	992	980	985	970	993	956	999
3582	(934)	(907)	990	980	984	966	992	962	1010
<u>Bacillus licheniformis B1001</u>									
3567	(921)	(898)	990	979	983	954	990	970	1002
3568	(920)	(894)	988	978	982	952	990	969	998
3607	(909)	(891)	979	966	973	940	981	960	993
3608	(904)	(870)	983	972	977	930	985	964	996

1890						1891		1892	
Jan	Feb	Mar	Apr	May	June	July	Aug	Sept	Oct
1890									
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	1	2	3	4	5	6	7	8	9
1891									
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	1	2	3	4	5	6	7	8
9	10	11	12	13	14	15	16	17	18
1892									
19	20	21	22	23	24	25	26	27	28
29	30	31	1	2	3	4	5	6	7
8	9	10	11	12	13	14	15	16	17
18	19	20	21	22	23	24	25	26	27
28	29	30	31	1	2	3	4	5	6
7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26
27	28	29	30	31	1	2	3	4	5
6	7	8	9	10	11	12	13	14	15
16	17	18	19	20	21	22	23	24	25
26	27	28	29	30	31	1	2	3	4
5	6	7	8	9	10	11	12	13	14
15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	1	2	3
4	5	6	7	8	9	10	11	12	13
14	15	16	17	18	19	20	21	22	23
24	25	26	27	28	29	30	31	1	2
3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22
23	24	25	26	27	28	29	30	31	1
2	3	4	5	6	7	8	9	10	11
12	13	14	15	16	17	18	19	20	21
22	23	24	25	26	27	28	29	30	31

Table 8 (Page 20)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus licheniformis NRS1263</u>									
3690	(930)	(905)	986	978	982	954	987	969	998
3691	(929)	(903)	987	979	982	955	988	970	1001
3734	(935)	(900)	992	982	988	961	993	974	1007
3735	(937)	(904)	991	983	987	963	993	972	1002
<u>Bacillus licheniformis NRS1264</u>									
3596	(926)	(903)	981	970	976	950	983	962	995
3597	(916)	(877)	979	965	972	(945)	981	956	993
3618	(912)	(868)	981	971	975	947	985	959	995
3619	(917)	(874)	979	969	974	945	983	957	994
<u>Bacillus macerans B172</u>									
3584	930	(915)	969	965	970	954	975	960	979
3585	930	(918)	970	968	971	953	975	962	980
3968	(888)	(865)	968	960	967	929	972	960	984
3969	(899)	(874)	968	961	967	930	972	959	984
3997	(896)	(884)	969	963	969	(931)	974	960	985
3998	(887)	(870)	967	964	969	(929)	970	959	985
<u>Bacillus macerans NRS1093</u>									
3039	945	(935)	989	980	986	968	994	966	998
3040	952	(934)	992	982	990	970	997	968	998
3713	(930)	(862)	979	970	974	956	982	958	989
<u>Bacillus macerans NRS1095</u>									
3038	(945)	(915)	990	981	988	968	995	969	1000
3045	(942)	(915)	987	980	984	964	990	968	998
<u>Bacillus megaterium NRS308</u>									
3518	(940)	(928)	992	978	979	956	988	976	1002
3519	(945)	(938)	987	975	976	955	986	977	1000
3552	(943)	(934)	994	979	980	963	990	973	1004
3553	(923)	(913)	988	975	977	939	987	973	1002
<u>Bacillus megaterium B350</u>									
3650	(944)	(933)	991	982	984	(964)	990	983	1006
3651	(938)	(926)	991	980	982	958	990	981	1003
3655	(940)	(930)	993	983	984	959	991	983	1005
3656	(940)	(929)	992	983	984	961	990	981	1005

Table 8 (Page 21)

Curve : no. :	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus megaterium B351</u>									
3661 :	(924)	(903)	981	971	976	936	984	965	1000
3662 :	(919)	(900)	981	973	976	940	984	996	999
3685 :	(923)	(904)	981	971	975	937	985	965	1000
3686 :	(919)	(888)	981	970	974	938	984	965	997
<u>Bacillus megaterium NRS607</u>									
2881 :	952	(945)	994	986	987	977	996	976	1005
2882 :	950	(940)	992	984	986	976	994	975	1000
2914 :	953	(947)	999	988	989	979	1000	980	1009
2918 :	(959)	(951)	1000	988	989	978	1000	983	1011
<u>Bacillus megaterium NRS608</u>									
3753 :	968	937	1009	994	995	983	1000	993	1006
3754 :	973	934	1012	996	996	985	1004	992	1009
3801 :	(964)	(961)	1005	992	993	978	999	991	1012
3802 :	(952)	(950)	998	990	990	972	996	990	1010
<u>Bacillus megaterium NRS610</u>									
3749 :	964	(934)	1011	990	991	981	1007	980	1010
3750 :	957	(925)	1007	991	993	980	1004	979	1008
3797 :	930	(938)	1003	989	992	980	1002	979	1011
3798 :	930	(940)	1004	990	993	979	1001	978	1010
<u>Bacillus megaterium NRS623</u>									
3755 :	(963)	(952)	1002	989	994	979	1000	984	1012
3756 :	(958)	(943)	1002	989	994	976	1001	980	1009
3783 :	(955)	(939)	1003	990	995	978	1002	981	1012
3784 :	(952)	(935)	998	986	991	975	996	980	1010
<u>Bacillus megaterium NRS627</u>									
3747 :	(958)	(950)	1012	995	996	980	1008	991	1010
3748 :	(955)	(948)	1008	992	994	977	1004	990	1009
3777 :	(930)	(922)	990	980	982	(956)	990	980	1009
3778 :	(925)	(919)	990	977	980	(953)	989	979	1005
<u>Bacillus megaterium NRS822</u>									
2915 :	(944)	(929)	989	981	983	972	992	971	1008
2916 :	(953)	(938)	991	984	986	974	994	973	1007
2879 :	950	(941)	995	986	988	978	998	978	1009
2880 :	(947)	(926)	989	981	983	972	992	974	1005

Table 8 (Page 22)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus megaterium</u> NRS824									
2926	955	(953)	997	988	989	979	998	979	1005
2927	954	(955)	997	988	989	979	997	980	1005
2959	(952)	(938)	990	984	985	974	993	976	1012
2960	(954)	(941)	992	985	985	975	995	976	1012
<u>Bacillus megaterium</u> NRS828									
3751	952	(955)	1005	991	992	982	1000	985	1010
3752	929	(949)	999	989	990	979	998	984	1009
3799	937	(962)	1014	998	1000	987	1009	990	1017
3800	(967)	(960)	1005	991	994	979	999	987	1011
<u>Bacillus megaterium</u> NRS829									
3761	974	930	1010	995	999	987	1005	993	1015
3762	974	(969)	1010	998	999	984	1004	992	1014
3793	959	(972)	1006	994	995	983	1000	990	1012
3794	933	(965)	1004	995	995	984	1000	991	1012
<u>Bacillus megaterium</u> NRS835									
3767	934	(941)	1006	992	995	979	1003	980	1005
3768	932	(942)	1002	989	992	976	999	977	1007
3791	(959)	(947)	1005	988	992	979	1004	980	1010
3792	(950)	(934)	1002	986	992	977	1000	980	1010
<u>Bacillus megaterium</u> NRS837									
3757	930	(938)	1004	989	992	975	1001	975	1010
3758	932	(936)	1005	988	993	976	1002	976	1013
3789	(955)	(935)	1002	989	992	978	1001	979	1010
3790	927	(937)	1007	990	996	979	1003	979	1011
<u>Bacillus megaterium</u> NRS872									
3775	(927)	(922)	1000	983	985	(955)	994	982	1025
3776	(936)	(932)	1001	984	984	(955)	993	979	1022
3803	(951)	(949)	996	985	985	964	993	981	1000
3804	(953)	(950)	1000	985	987	968	995	982	1002
<u>Bacillus megaterium</u> NRS892									
3696	(949)	(930)	985	975	978	966	985	967	992
3697	935	(932)	991	979	982	970	990	969	993
3736	(940)	(922)	987	977	979	965	988	968	997
3737	(945)	(929)	990	980	982	968	992	969	998

Table 8 (Page 23)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus megaterium</u> NRS895									
3554	(935)	(925)	990	979	981	960	991	974	1008
3555	(944)	(938)	994	980	984	964	994	975	1011
3560	(941)	(935)	995	981	983	963	994	979	1005
3561	(942)	(936)	996	981	986	965	995	979	1005
<u>Bacillus megaterium</u> NRS907									
3771	(964)	(950)	1005	993	995	980	1003	984	1014
3772	(961)	(948)	1004	990	994	978	1000	982	1012
3781	(960)	(950)	1006	990	994	979	999	982	1011
3782	(956)	(944)	1001	988	990	976	999	981	1010
<u>Bacillus megaterium</u> NRS923									
3769	937	(945)	1011	994	995	970	1004	989	1008
3770	966	935	1037	1006	1007	980	1014	994	1014
3779	(937)	(933)	989	977	979	(958)	987	980	1005
3780	(933)	(925)	996	983	984	(959)	990	982	1008
<u>Bacillus megaterium</u> NRS931									
3765	949	(918)	991	980	985	971	996	964	1005
3766	953	(935)	993	982	988	973	1000	965	1000
3787	(930)	(906)	981	971	977	956	983	957	1004
3788	(929)	(904)	984	973	978	955	985	960	1005
<u>Bacillus pantothenicus</u> NRS1317									
3716	930	(911)	992	984	987	971	995	962	997
3746	968	(937)	1004	994	995	984	1004	978	1015
<u>Bacillus pantothenicus</u> NRS1318									
3642	954	(908)	984	971	981	970	988	945	984
3643	954	(912)	983	972	982	970	989	948	985
3672	974	(939)	997	985	991	982	999	963	984
3673	971	(931)	994	984	991	982	998	962	986
<u>Bacillus pantothenicus</u> NRS1319									
2934	965	(927)	1004	989	992	981	1010	974	994
2935	962	(928)	1000	987	990	979	1005	973	994
2971	(933)	(906)	987	973	977	961	990	961	996

Year	Month	Day	Time	Place	Remarks	Signature	Witness
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Table 8 (Page 24)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus pantothenicus NRS1320</u>									
2922	(945)	(920)	992	981	984	968	995	962	1006
2941	993	971	1048	1008	1011	998	1046	990	1007
2942	989	957	1049	1001	1004	994	1018	983	999
2972	(925)	(883)	991	980	983	958	995	957	1010
3043	970	(936)	1000	990	995	986	1009	965	1005
<u>Bacillus polymyxa B174</u>									
2885	(929)	(881)	980	973	975	957	988	957	991
2886	(941)	(894)	984	976	982	965	992	963	998
2912	(918)	(881)	971	963	968	943	978	950	987
2913	(918)	(879)	972	964	969	943	979	949	987
<u>Bacillus polymyxa B368</u>									
3586	956	(936)	987	981	985	971	995	970	987
3587	954	(922)	985	980	984	969	990	969	987
3621	(929)	(898)	972	966	971	952	978	947	985
<u>Bacillus polymyxa B372</u>									
3634	936	(908)	979	972	978	964	985	970	990
3635	933	(906)	978	970	975	958	984	970	989
3668	(915)	(876)	970	962	970	940	978	955	989
3669	(912)	(866)	972	962	969	939	979	954	988
<u>Bacillus polymyxa NRS1105</u>									
2887	(920)	(896)	974	964	972	949	981	948	990
2989	(915)	(887)	974	961	971	947	981	947	989
2910	(913)	(885)	977	968	974	946	984	958	993
2911	(913)	(881)	975	966	972	944	982	957	992
<u>Bacillus pulvifaciens NRS1284</u>									
3564	(928)	(867)	973	967	972	946	979	953	990
3623	(920)	(890)	975	968	974	945	982	950	994
<u>Bacillus pulvifaciens NRS1285</u>									
2953	957	(935)	998	989	991	971	997	980	998
2954	958	(935)	998	988	991	973	998	982	999

Table 8 (Page 25)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus pumilus NRS272</u>									
3590	(910)	(892)	975	967	972	(940)	980	962	993
3591	(914)	(895)	979	970	975	(944)	981	964	994
3599	(915)	(874)	975	967	972	(944)	981	958	991
3600	(926)	(895)	979	969	974	946	983	961	994
<u>Bacillus pumilus NRS630</u>									
3683	(919)	(893)	976	964	970	(942)	980	958	993
3684	(916)	(886)	975	965	970	(944)	979	956	993
3739	(932)	(911)	984	974	979	953	986	964	996
3738	(925)	(888)	983	973	977	949	985	962	994
<u>Bacillus pumilus NRS939</u>									
2873	(910)	(891)	972	956	962	(938)	978	952	992
2874	(902)	(878)	973	956	965	(933)	978	954	991
2897	(919)	(894)	978	968	973	(944)	983	958	996
2898	(915)	(886)	976	965	971	(941)	981	958	995
2906	(939)	(925)	985	976	977	953	988	974	994
2907	(933)	(907)	985	977	980	955	989	970	995
<u>Bacillus pumilus B1489</u>									
2932	(925)	(900)	979	980	975	949	984	959	995
2933	(928)	(900)	979	971	975	945	984	960	997
2961	(937)	(920)	983	974	978	961	987	964	997
2962	(938)	(919)	986	977	980	962	990	966	999
<u>Bacillus sphaericus NRST156</u>									
2893	(910)	(862)	961	948	959	936	975	953	983
2894	(908)	(856)	965	953	961	938	975	953	984
2871	(941)	(900)	979	970	975	963	985	965	981
2876	(946)	(899)	981	973	978	965	987	969	983
<u>Bacillus sphaericus NRS344</u>									
3576	(924)	(887)	971	963	969	948	978	956	983
3577	(920)	(862)	975	965	972	951	981	959	984
3611	(924)	(856)	980	969	975	953	984	963	988
3612	(928)	(870)	982	970	975	954	984	965	988

Table 8 (Page 26)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus sphaericus NRS348</u>									
3687	(911)	(858)	974	957	967	940	979	950	986
3688	(911)	(851)	974	959	968	942	978	950	985
3719	(918)	(864)	974	959	968	943	978	952	985
3720	(928)	(877)	986	973	979	958	988	963	993
<u>Bacillus sphaericus NRS966</u>									
2923	(906)	(851)	970	953	964	932	980	952	991
2948	(918)	(897)	969	954	963	930	979	954	987
2967	(889)	(848)	965	945	958	(930)	979	937	991
2968	(898)	(862)	966	950	962	(935)	978	939	991
<u>Bacillus subtilis B543</u>									
3702	(920)	(888)	989	980	983	958	991	968	997
3703	(903)	(868)	987	978	981	954	988	967	998
3721	(920)	(861)	985	976	976	955	988	963	997
3722	(919)	(863)	985	978	981	956	988	964	1000
<u>Bacillus subtilis B558</u>									
3692	(953)	(935)	1001	994	997	974	1000	984	1010
3693	958	(924)	1004	995	998	980	1004	984	1009
3725	(949)	(930)	997	990	995	974	999	982	1007
3726	(942)	(918)	996	990	993	970	998	979	1005
<u>Bacillus subtilis NRS743</u>									
2867	(934)	(886)	992	980	985	963	995	965	996
2868	(940)	(892)	990	980	983	962	995	964	995
3034	(923)	(880)	990	979	980	958	995	964	998
3035	(920)	(885)	990	978	980	956	995	964	997
<u>Bacillus subtilis NRS744</u>									
2917	(907)	(879)	989	977	981	953	990	974	1000
2869	(893)	(856)	983	971	978	945	985	965	999
2870	(904)	(872)	983	972	977	945	986	965	1000
<u>Bacillus subtilis B765</u>									
3572	(940)	(910)	995	986	990	965	994	974	998
3573	(925)	(896)	989	981	985	960	990	972	998
3613	(927)	(890)	985	976	981	956	987	964	998
3614	(920)	(876)	983	975	981	954	986	960	995

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Table 8 (Page 27)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus subtilis B971</u>									
3578	(900)	(843)	981	972	974	948	984	965	998
3580	(916)	(869)	980	972	980	949	985	964	997
3610	933	(892)	992	980	985	961	990	968	1002
<u>Bacillus Variety aterrimus B362</u>									
3592	(900)	(859)	985	976	977	949	987	968	998
3593	(895)	(840)	983	974	979	944	985	968	996
3617	(920)	(856)	988	978	982	957	989	964	995
3630	(920)	(892)	985	975	981	955	988	965	998
<u>Bacillus subtilis Variety aterrimus NRS653</u>									
3704	(931)	(856)	988	979	984	964	990	969	995
3730	(925)	(888)	990	981	985	963	992	971	995
3727	(919)	(859)	985	976	982	956	988	965	998
3728	(912)	(831)	985	976	982	955	988	965	998
<u>Bacillus subtilis Variety aterrimus NRS659</u>									
2862	(892)	(856)	980	968	973	936	985	960	995
2863	(890)	(830)	983	975	980	946	989	968	999
2891	(893)	(828)	980	970	974	941	985	959	997
2892	(893)	(849)	982	972	976	944	985	962	997
<u>Bacillus subtilis Variety aterrimus NRS740</u>									
2866	(914)	(850)	989	979	982	951	990	969	996
2875	(890)	(853)	985	974	976	948	986	967	995
2901	(912)	(843)	987	976	981	958	990	959	996
2902	(908)	(813)	987	976	980	955	989	957	995
2903	(945)	(895)	990	982	985	970	993	971	995
2905	(940)	(892)	991	982	985	970	993	971	995
<u>Bacillus subtilis Variety niger NRS264</u>									
3689	(923)	(875)	985	978	981	965	990	973	1000
3700	(926)	(900)	989	979	982	964	989	974	998
3742	(928)	(875)	989	979	982	963	990	972	1002
3743	(927)	(870)	990	980	984	967	991	974	1002

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Table 8 (Page 28)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Bacillus subtilis</u> Variety <u>niger</u> B364									
3569	(927)	(875)	990	981	985	967	991	973	1002
3579	(915)	(865)	991	983	982	964	994	974	1003
3615	(929)	(874)	988	979	984	966	990	970	1000
3616	(925)	(874)	985	977	982	963	987	970	998
<u>Bacillus subtilis</u> Variety <u>niger</u> NRS650									
2877	(897)	(839)	981	971	974	948	984	963	995
2878	(908)	(867)	982	972	975	951	985	965	998
2899	(915)	(865)	981	972	975	954	985	966	995
2900	(923)	(879)	984	974	978	956	989	970	997
<u>Bacillus subtilis</u> Variety <u>niger</u> NRS651									
2883	(931)	(892)	993	982	986	968	993	975	1004
2884	(930)	(894)	990	979	983	964	992	974	1001
2895	(927)	(898)	987	978	980	958	990	973	1001
2896	(914)	(868)	986	975	980	959	989	971	1000
<u>Bacillus technicus</u> B675									
3707	(944)	(925)	990	981	986	964	991	973	995
3708	(930)	(905)	987	976	980	957	987	972	994
3740	(940)	(915)	988	979	984	962	990	991	997
3741	(937)	(914)	986	977	982	959	988	968	997
<u>Pseudomonas aeruginosa</u> B7									
3082	(937)	(881)	977	963	974	960	985	943	988
3083	(940)	(886)	977	964	974	960	985	940	988
3123	956	(905)	987	980	988	975	997	954	993
3124	956	(892)	987	980	987	974	995	954	991
<u>Pseudomonas aeruginosa</u> B12									
3120	956	(956)	991	980	989	978	998	964	993
3119	962	(917)	993	984	991	975	998	961	994
3051	944	(909)	988	974	982	966	994	954	993
3052	943	(910)	989	974	982	968	993	955	994
3131	953	(917)	990	975	985	973	994	962	989
<u>Pseudomonas aeruginosa</u> B23									
3049	(932)	(892)	980	968	975	960	985	956	989
3050	(913)	(850)	977	961	969	954	983	954	988
3127	949	(900)	984	974	980	970	989	959	991
3128	935	(906)	985	974	982	969	990	961	992

Table 8 (Page 29)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B26</u>									
3415	930	(883)	984	970	979	962	987	953	988
3416	925	(887)	982	967	974	959	984	946	985
3478	(930)	(881)	984	969	980	962	990	949	991
3479	(935)	(876)	985	970	981	963	990	948	992
<u>Pseudomonas aeruginosa B27</u>									
3053	(935)	(898)	984	969	979	960	988	956	989
3054	(935)	(892)	980	969	975	957	987	955	988
3241	945	(902)	983	971	980	965	987	949	988
3242	942	(907)	981	972	980	968	990	950	990
<u>Pseudomonas aeruginosa B79</u>									
3076	(939)	(898)	984	970	976	964	988	956	989
3077	(931)	(884)	980	966	974	960	985	953	988
3093	932	(885)	982	970	975	964	985	960	988
3094	945	(886)	984	972	979	966	987	961	989
<u>Pseudomonas aeruginosa B189</u>									
3433	936	(892)	979	969	975	964	983	955	984
3434	930	(893)	979	968	975	963	982	956	985
3480	930	(895)	977	968	975	964	982	955	984
3481	940	(904)	981	970	977	965	985	955	986
<u>Pseudomonas aeruginosa B211</u>									
3078	954	(887)	985	975	981	970	989	958	989
3079	955	(900)	988	975	985	973	992	961	991
3091	955	(892)	990	977	986	971	993	967	992
3092	958	(907)	993	980	986	973	994	965	994
<u>Pseudomonas aeruginosa B217</u>									
3070	(930)	(878)	985	973	981	962	989	947	990
3099	961	(919)	990	981	987	973	994	964	992
3100	958	(918)	990	978	985	972	993	962	991
<u>Pseudomonas aeruginosa B218</u>									
3490	(928)	(874)	974	962	971	955	980	948	983
3491	(930)	(869)	977	965	973	959	983	948	984
3527	942	(891)	984	970	977	965	986	956	985
3528	946	(880)	984	970	978	966	985	957	985

Table 8 (Page 30)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B219</u>									
3431	(933)	(870)	984	969	977	960	987	950	990
3432	(931)	(864)	982	968	976	958	984	952	988
3466	(935)	(871)	982	969	976	961	985	955	987
3467	(939)	(881)	982	967	973	961	985	954	988
<u>Pseudomonas aeruginosa B220</u>									
3498	944	(904)	984	973	980	969	984	959	984
3499	935	(897)	982	970	978	965	987	957	989
3548	958	(900)	991	978	985	973	991	966	990
3549	960	(907)	992	979	987	973	994	966	991
<u>Pseudomonas aeruginosa B221</u>									
3074	933	(886)	982	969	975	964	985	957	984
3075	933	(894)	982	969	977	965	985	956	985
3110	939	(898)	983	970	979	966	986	955	986
3111	947	(896)	985	973	980	969	984	960	983
<u>Pseudomonas aeruginosa B241</u>									
3046	(942)	(904)	976	964	974	959	985	945	985
3047	(933)	(881)	978	967	975	961	987	944	989
3086	(931)	(889)	974	964	972	954	982	950	986
3087	(931)	(879)	975	964	972	955	981	954	987
<u>Pseudomonas aeruginosa B247</u>									
3062	(941)	(884)	981	967	976	963	986	953	988
3064	939	(886)	983	971	980	964	990	951	989
3103	(939)	(884)	980	966	975	961	987	955	988
3104	(935)	(884)	978	967	974	960	985	955	986
<u>Pseudomonas aeruginosa B248</u>									
3407	(919)	(849)	974	960	970	951	981	948	984
3408	(925)	(863)	976	963	971	953	981	946	985
3448	933	(899)	979	966	974	962	985	954	985
3449	930	(882)	981	966	975	962	985	954	984
<u>Pseudomonas aeruginosa B249</u>									
3417	(924)	(884)	976	960	972	951	980	935	985
3418	(918)	(877)	973	958	968	949	979	937	983
3464	(925)	(884)	975	964	973	958	982	941	983
3465	(926)	(885)	976	963	973	959	981	939	985

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B250</u>									
3425	928	(897)	977	965	974	960	984	951	985
3426	938	(907)	984	970	979	965	989	949	986
3460	929	(891)	977	965	975	960	985	941	985
3461	(935)	(893)	978	964	974	960	982	938	985
<u>Pseudomonas aeruginosa B255</u>									
3413	(934)	(898)	985	969	977	961	985	952	986
3414	(937)	(896)	981	966	975	960	985	953	985
3446	(934)	(894)	984	969	978	960	986	949	987
3447	(939)	(900)	987	973	980	965	988	957	990
<u>Pseudomonas aeruginosa B256</u>									
3411	932	(892)	981	966	975	961	985	958	984
3412	938	(897)	984	970	977	964	984	958	984
3474	952	(901)	983	970	978	968	986	956	983
3475	951	(905)	984	971	979	968	987	960	983
<u>Pseudomonas aeruginosa B257</u>									
3096	(932)	(892)	977	965	973	959	984	953	987
3060	(931)	(892)	976	964	972	959	984	952	986
3129	(937)	(894)	976	964	972	959	982	947	983
3061	(934)	(888)	976	967	974	961	985	955	988
<u>Pseudomonas aeruginosa B260</u>									
3097	942	(906)	982	971	978	967	985	955	987
3098	942	(892)	979	970	977	966	984	957	986
3048	943	(921)	986	974	979	966	989	966	985
<u>Pseudomonas aeruginosa B265</u>									
3122	948	(905)	989	973	982	969	990	960	991
3059	944	(904)	980	971	977	967	987	955	987
3121	930	(892)	981	968	977	963	986	956	987
3058	941	(897)	979	970	977	966	986	958	987
<u>Pseudomonas aeruginosa B275</u>									
3427	943	(898)	982	970	979	964	985	950	987
3428	949	(905)	982	971	981	964	987	951	987
3472	944	(900)	985	971	981	965	989	952	990
3473	944	(894)	983	971	980	965	987	950	987

Table 8 (Page 32)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B282</u>									
3409	(933)	(902)	971	959	969	953	979	937	984
3410	(932)	(895)	973	959	970	957	979	938	985
3462	946	(902)	978	968	975	968	986	952	984
3463	950	(909)	980	971	978	969	986	952	985
<u>Pseudomonas aeruginosa B323</u>									
3195	955	(907)	987	974	984	970	989	950	990
3161	955	(903)	990	977	985	973	992	961	995
3160	957	(908)	991	975	986	974	992	962	994
3194	952	(900)	985	974	987	969	991	950	992
<u>Pseudomonas aeruginosa B325</u>									
3482	925	(905)	986	973	981	966	989	954	990
3483	930	(894)	985	970	979	964	987	953	990
3525	958	(905)	990	977	984	973	989	954	990
3562	958	(905)	989	976	984	972	990	958	989
<u>Pseudomonas aeruginosa B428</u>									
3423	953	(915)	985	974	979	970	986	964	989
3424	943	(913)	982	970	977	967	985	963	987
3454	953	(914)	987	974	979	970	987	964	987
3455	948	(912)	984	973	979	970	986	964	987
<u>Pseudomonas aeruginosa B431</u>									
3201	(936)	(905)	976	963	973	957	982	944	982
3200	(935)	(903)	979	964	974	959	984	942	984
3155	(932)	(905)	978	964	974	959	984	945	984
3154	(937)	(899)	978	965	975	958	983	948	985
<u>Pseudomonas aeruginosa B450</u>									
3441	934	(903)	983	970	980	964	987	953	989
3442	934	(900)	982	965	975	961	985	953	986
3476	952	(905)	987	972	981	970	989	960	989
3477	948	(906)	985	970	979	970	988	959	987
<u>Pseudomonas aeruginosa B451</u>									
3486	(940)	(910)	984	970	979	964	989	950	990
3487	(939)	(902)	984	967	979	964	987	950	989
3540	957	(915)	995	974	987	974	995	961	994
3541	957	(917)	992	979	987	974	992	960	992

Table 8 (Page 33)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B452</u>									
3437	953	(904)	989	975	983	970	990	960	990
3438	950	(906)	989	974	982	971	990	961	990
3456	930	(897)	985	974	981	965	988	957	990
3457	936	(901)	988	975	982	967	990	959	990
<u>Pseudomonas aeruginosa B534</u>									
3138	938	(883)	979	967	977	962	986	948	986
3178	946	(897)	985	970	979	967	988	955	988
3179	948	(904)	985	970	979	965	987	955	985
3139	936	(888)	977	964	974	960	982	947	982
<u>Pseudomonas aeruginosa B716</u>									
3439	942	(912)	984	971	980	965	987	954	989
3440	948	(905)	988	974	984	969	989	955	990
3468	949	(903)	992	977	985	971	992	959	992
3469	930	(900)	987	973	981	966	989	956	990
<u>Pseudomonas aeruginosa B743</u>									
3134	939	(908)	988	977	984	971	990	963	994
3183	954	(896)	987	977	983	972	991	964	994
3182	959	(907)	990	977	983	975	992	964	994
3135	948	(900)	989	977	985	974	995	965	995
<u>Pseudomonas aeruginosa B771</u>									
3137	(936)	(895)	984	970	980	965	978	956	992
3165	(935)	(894)	983	968	976	961	987	959	992
3164	(937)	(900)	981	969	976	962	985	960	990
3136	(935)	(892)	983	969	978	962	988	956	992
<u>Pseudomonas aeruginosa B786</u>									
3502	(938)	(900)	981	967	975	960	986	950	987
3503	(935)	(902)	977	964	972	954	983	944	985
3550	951	(909)	989	975	984	970	992	962	990
3551	950	(912)	989	975	983	969	992	961	989
<u>Pseudomonas aeruginosa B800</u>									
3488	939	(901)	983	967	977	965	987	955	985
3489	943	(906)	985	970	978	966	987	953	985
3532	950	(905)	982	969	977	966	985	954	984
3533	951	(907)	987	970	979	967	988	951	987

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B804</u>									
3208	977	(955)	991	981	984	980	993	974	989
3152	946	(903)	990	981	987	967	996	952	998
3153	950	(915)	994	984	992	970	1000	953	1002
<u>Pseudomonas aeruginosa B822</u>									
3157	(932)	(896)	975	961	971	953	982	943	988
3206	927	(900)	978	964	976	959	984	942	990
3207	(935)	(893)	977	965	974	957	985	940	987
3156	(932)	(894)	979	962	975	956	985	943	990
<u>Pseudomonas aeruginosa B853</u>									
3492	929	(900)	982	969	977	965	989	953	989
3493	(939)	(900)	980	967	977	963	986	954	989
3529	936	(899)	982	968	976	966	985	955	986
3530	941	(898)	982	970	977	966	986	953	985
<u>Pseudomonas aeruginosa B903</u>									
3265	975	969	999	984	984	977	995	974	992
3275	974	965	995	983	983	976	995	972	987
3266	968	923	988	977	977	971	987	971	983
3276	973	965	1000	985	985	976	995	972	987
<u>Pseudomonas aeruginosa B904</u>									
3236	965	(950)	986	977	978	970	986	966	986
3237	965	(948)	989	979	980	972	988	968	988
3267	968	(950)	993	981	981	974	991	972	989
3268	(961)	(942)	985	976	976	970	987	970	985
<u>Pseudomonas aeruginosa B937</u>									
3239	947	(905)	982	971	980	967	987	955	989
3240	944	(907)	981	970	978	965	987	953	988
3277	953	(907)	984	972	980	969	987	958	986
3278	964	(918)	991	977	986	973	994	958	987
<u>Pseudomonas aeruginosa B982</u>									
3496	938	(905)	982	967	975	965	986	954	985
3497	933	(903)	979	966	974	962	984	953	985
3523	941	(894)	985	971	978	967	987	951	987
3524	933	(898)	982	969	978	965	985	952	986

Table 8 (Page 35)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B997</u>									
3224	948	(909)	985	974	982	966	989	947	992
3225	943	(903)	984	973	981	964	989	949	991
3253	954	(909)	990	980	987	974	995	954	996
3254	957	(909)	992	982	990	975	996	954	996
<u>Pseudomonas aeruginosa B1000</u>									
3648	(925)	(884)	975	959	969	953	979	938	984
3649	(927)	(884)	977	963	974	956	984	945	986
3675	930	(885)	975	960	972	958	981	942	982
3676	932	(897)	976	962	973	960	983	942	983
<u>Pseudomonas aeruginosa B1019</u>									
3282	950	(904)	973	964	972	965	979	943	975
3283	938	(897)	967	954	967	956	976	938	974
3401	933	(890)	966	955	964	953	974	932	975
3402	930	(894)	969	956	968	954	975	930	975
<u>Pseudomonas aeruginosa B1069</u>									
3633	935	(896)	978	966	976	963	985	942	985
3663	947	(907)	979	967	975	965	984	950	979
3674	930	(904)	973	962	972	960	981	941	984
3682	943	(902)	977	965	973	962	983	952	979
<u>Pseudomonas aeruginosa B1080</u>									
3279	942	(898)	983	970	980	964	989	952	987
3280	938	(892)	981	967	977	960	987	948	987
3391	934	(893)	980	964	975	960	985	946	985
3392	(931)	(892)	979	962	974	957	983	940	985
<u>Pseudomonas aeruginosa B1083</u>									
3314	942	(901)	982	969	977	966	985	952	986
3315	948	(903)	985	974	981	969	989	956	988
3361	932	(904)	987	974	980	966	990	957	991
3362	930	(898)	985	970	977	963	986	954	985
<u>Pseudomonas aeruginosa B1087</u>									
3318	954	(908)	987	973	982	970	988	955	988
3319	944	(900)	982	967	976	964	985	952	985
3349	954	(918)	987	977	985	970	992	959	990
3350	954	(917)	989	977	986	971	994	957	992

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas aeruginosa B1088</u>									
3308	939	(909)	973	957	973	958	980	932	974
3309	934	(900)	967	955	967	955	976	929	974
3365	945	(905)	975	963	975	163	984	935	977
3366	948	(910)	977	964	975	964	985	933	978
<u>Pseudomonas aeruginosa B1235</u>									
3355	(934)	(887)	980	967	975	958	985	942	987
3356	(938)	(898)	982	966	976	961	985	946	986
3371	(937)	(900)	977	963	972	956	981	946	985
3372	(934)	(897)	976	963	972	958	981	945	983
<u>Pseudomonas aeruginosa B1236</u>									
3331	(930)	(900)	974	960	970	952	981	938	985
3332	(932)	(893)	978	965	974	956	984	943	987
3369	(932)	(896)	976	963	972	955	981	942	985
3370	(929)	(887)	978	962	973	955	982	944	985
<u>Pseudomonas aeruginosa B1247</u>									
3333	937	(901)	985	971	979	970	989	956	990
3334	(935)	(899)	981	967	975	960	986	955	989
3393A	939	(903)	985	973	980	967	986	955	989
3393B	943	(891)	986	975	982	970	989	956	990
3394	933	(918)	982	970	978	965	987	952	990
<u>Pseudomonas aeruginosa B1360</u>									
3298	940	(913)	982	967	976	962	983	956	982
3299	934	(902)	980	967	975	962	984	956	982
3339	(940)	(897)	980	968	975	962	984	953	985
3340	930	(902)	986	972	979	965	988	959	988
<u>Pseudomonas aeruginosa B1361</u>									
3345	936	(910)	979	965	975	962	984	950	985
3346	942	(907)	983	967	977	965	986	952	986
3367	945	(902)	980	968	974	965	983	955	982
3368	947	(907)	980	967	975	964	983	955	981
<u>Pseudomonas aeruginosa B1362</u>									
3286	(937)	(902)	976	962	971	957	982	947	988
3287	(938)	(895)	975	962	971	956	980	948	985
3302	(940)	(900)	978	965	974	958	984	949	985
3303	(937)	(901)	978	965	974	959	984	950	986

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas acidovorans B802</u>									
3166	: 948	(875)	980	967	977	965	985	954	989
3167	: 939	(867)	974	961	973	958	981	949	985
3198	: 947	(874)	979	966	976	962	985	952	988
3934	: 950	(888)	985	971	982	967	987	954	987
3935	: 954	(894)	987	973	980	972	990	957	989
3947	: 956	(900)	990	975	984	972	991	960	990
3948	: 957	(918)	990	976	984	974	992	963	990
<u>Pseudomonas acidovorans B819</u>									
3484	: (934)	(879)	975	958	973	956	982	950	987
3485	: (930)	(856)	973	957	972	954	981	947	984
3534	: 939	(898)	976	966	974	961	984	959	987
3925	: 944	(899)	980	968	977	965	986	960	989
<u>Pseudomonas cruciviae B932</u>									
3229	: (934)	(889)	967	956	967	952	978	949	984
3230	: (936)	(880)	970	957	969	953	978	949	984
3255	: 942	(895)	979	967	976	961	985	958	987
3256	: 944	(887)	981	967	978	965	988	960	988
<u>Pseudomonas alliicola B823</u>									
3192	: (914)	(854)	975	957	971	935	981	941	989
3193	: (915)	(855)	973	957	970	935	980	947	989
3211	: (966)	(913)	997	982	990	974	994	973	997
3926	: (938)	(887)	985	974	980	960	989	956	989
3927	: (929)	(874)	978	966	972	951	983	950	984
<u>Pseudomonas alliicola B828</u>									
2999	: 950	(910)	977	966	975	960	985	955	982
3000	: 949	(910)	977	965	975	959	982	954	980
3029	: 958	(926)	987	974	983	969	990	966	983
3030	: 959	(926)	986	975	983	970	989	965	981
<u>Pseudomonas aminovorans B934</u>									
2860	: 948	(910)	987	977	982	965	990	960	986
2861	: 948	(920)	985	975	981	963	987	959	985
2908	: 955	(919)	989	979	984	970	991	965	986
2909	: 953	(920)	987	977	982	967	990	965	985

Table 8 (Page 38)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas angulata B821</u>									
3174	953	(914)	987	975	983	971	990	966	995
3175	955	(900)	986	975	984	970	991	964	994
3202	946	(904)	985	975	983	969	990	958	999
3203	938	(889)	985	974	980	967	990	956	996
<u>Pseudomonas angulata B824</u>									
2982	974	(932)	1007	990	995	985	1011	983	1014
2983	971	(941)	1005	989	994	984	1010	982	1013
2986	969	(918)	1003	990	994	982	1017	981	1014
3013	955	(936)	1000	987	989	980	1003	980	1016
3014	965	(934)	1006	989	990	983	1008	982	1017
<u>Pseudomonas angulata B825</u>									
2976	985	(954)	1015	1000	1008	991	1015	990	1018
2977	986	(961)	1015	999	1009	992	1014	990	1017
2980	988	(957)	1017	1002	1011	995	1016	990	1020
2981	986	(963)	1015	998	1009	992	1015	990	1019
3009	984	(960)	1014	997	1006	991	1015	990	1019
3010	985	(965)	1015	998	1006	991	1015	990	1020
3188	980	(935)	1010	985	990	980	1009	975	1016
3189	974	(939)	1015	986	992	982	1015	978	1018
3204	979	(948)	1009	990	996	987	1010	985	1016
3205	980	(951)	1009	990	998	986	1010	985	1016
<u>Pseudomonas apii B772</u>									
3404	945	(904)	985	975	982	970	990	949	1005
3441	965	(913)	996	981	987	979	993	965	993
<u>Pseudomonas atrofaciens B773</u>									
3500	953	(925)	989	978	985	974	992	970	1000
3501	956	(927)	989	978	985	975	992	970	1000
3546	955	(918)	988	977	985	974	990	965	995
3547	952	(923)	990	978	985	974	992	963	997
<u>Pseudomonas atrofaciens B827</u>									
3158	961	(919)	982	973	979	970	985	957	982
3212	954	(902)	984	974	979	971	986	946	985
3805	969	(922)	994	981	986	980	995	966	995

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas barkeri B830</u>									
3213	996	937	990	979	982	977	990	968	985
3162	951	(899)	981	969	978	969	989	950	984
3163	986	(909)	990	976	983	974	982	952	985
4000	954	(902)	990	979	986	975	1001	955	993
4001	958	(900)	992	981	988	976	1000	956	995
<u>Pseudomonas boreopolis B549</u>									
3176	930	(887)	970	956	970	956	978	946	978
3177	941	(892)	971	960	970	957	978	948	977
<u>Pseudomonas boreopolis B550</u>									
3171	939	900	976	962	971	958	983	950	987
3149	(929)	(881)	975	959	966	955	981	944	985
3170	941	(890)	979	962	974	961	983	949	986
3148	932	(871)	979	961	970	958	985	948	990
<u>Pseudomonas calco-acetica B803</u>									
3186	(936)	(881)	978	966	971	956	979	950	986
3196	935	(896)	979	966	971	960	981	904	985
3197	930	(890)	980	970	975	961	982	955	986
3187	926	(896)	977	966	972	959	979	950	986
<u>Pseudomonas calco-acetica B933</u>									
2996	987	(969)	1024	1015	1016	997	1020	1008	1026
3012	985	(967)	1024	1018	1017	1000	1021	1006	1028
3011	983	(966)	1024	1015	1017	994	1020	995	1026
2998	992	(971)	1025	1018	1019	1010	1021	1011	1026
3565	980	(959)	1024	1013	1015	991	1020	989	1026
3566	980	(964)	1026	1018	1019	991	1022	989	1034
3605	968	(942)	1019	987	1012	980	1017	977	1025
3606	968	(941)	1021	989	1014	979	1019	976	1024
<u>Pseudomonas caviae B966</u>									
3218	(928)	(880)	978	970	974	961	981	943	983
3996	950	(905)	990	979	984	972	992	960	1012
<u>Pseudomonas caviae B967</u>									
3226	950	(872)	990	981	984	970	991	959	990
3243	960	(921)	983	977	979	974	988	974	988
3995	951	(891)	990	978	986	970	1013	954	991

Table 8. (Page 40)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas caviae B968</u>									
3219	(924)	(862)	974	962	971	956	979	949	983
3234	(929)	(876)	979	967	975	958	982	953	989
3994	959	(903)	1000	983	993	976	1018	957	1000
<u>Pseudomonas chlororaphis B560</u>									
3142	954	(891)	981	972	979	971	989	952	989
3180	968	(890)	992	978	988	976	996	951	988
3181	962	(894)	986	975	982	974	992	951	986
3143	957	(898)	981	973	981	971	988	956	987
3806	962	(893)	987	976	986	973	992	955	988
3807	959	(900)	986	975	983	973	990	957	991
<u>Pseudomonas chlororaphis B561</u>									
3185	971	(901)	996	979	990	979	1001	954	987
3184	970	(901)	996	982	991	979	1007	953	988
3150	949	(878)	979	970	980	969	986	943	988
3151	949	(886)	979	970	978	969	987	946	990
3810	962	(883)	989	978	987	975	996	957	992
3811	961	(890)	987	977	985	973	992	956	992
3955	962	(888)	989	975	984	975	998	956	991
3956	961	(885)	989	976	987	974	996	956	990
<u>Pseudomonas chlororaphis B977</u>									
2987	954	(895)	986	974	984	971	995	943	986
2988	952	(905)	984	972	982	967	988	945	981
3964	964	(917)	989	972	981	972	989	948	976
3965	965	(910)	993	975	983	973	989	945	978
<u>Pseudomonas chlororaphis B1095</u>									
3348	977	(930)	998	981	992	985	999	972	991
3379	966	(899)	991	976	986	977	992	951	984
3380	961	(891)	988	976	982	975	990	952	986
3922	977	(925)	995	982	990	982	998	964	986
3940	959	(882)	986	971	982	969	992	953	987
<u>Pseudomonas chlororaphis B1541</u>									
2978	969	(928)	988	977	986	976	993	959	985
2979	974	(918)	991	981	988	979	997	963	986
3024	954	(876)	982	968	981	971	989	941	985
3025	953	(882)	981	971	980	971	989	942	986
3814	947	(875)	985	972	981	966	987	956	989
3815	951	(874)	985	974	983	969	989	956	990
3939	945	(864)	982	967	975	963	984	944	982

Table 8 (Page 41)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas cichorii B832</u>									
3928	967	(896)	996	986	991	981	1005	967	997
3929	956	(881)	987	980	986	975	993	961	996
3949	956	(906)	986	976	986	972	992	952	991
3950	951	(886)	979	974	981	967	987	952	987
<u>Pseudomonas cruciviae B1021</u>									
3284	932	(883)	970	961	970	956	977	943	977
3285	934	(875)	969	960	970	956	978	941	980
3399	944	(880)	974	961	969	956	976	939	977
3400	944	(882)	978	970	976	964	986	947	984
3924	965	(906)	995	983	991	976	1007	966	1008
3925	976	(915)	1050	1013	1045	990	1050	969	1048
3943	976	932	1051	1011	1038	988	1050	975	1010
3944	970	(919)	1044	991	1012	979	1039	966	996
<u>Pseudomonas denitrificans B1028</u>									
3027	952	(901)	984	973	980	971	992	968	987
3026	965	(913)	992	980	985	975	996	973	991
2993	(929)	(880)	973	960	970	955	981	951	983
2992	925	(881)	975	962	970	956	984	952	984
<u>Pseudomonas desmolyticum B979</u>									
3220	(931)	(883)	977	963	975	956	983	948	987
3221	935	(892)	986	972	981	966	989	951	992
3257	(931)	(890)	983	970	977	961	987	951	990
3258	(930)	(880)	981	967	977	958	986	948	987
<u>Pseudomonas eisenbergii B993</u>									
3244	979	(918)	1020	993	1016	992	1043	972	1001
3245	969	(910)	1000	986	994	982	1016	968	996
3274	970	(918)	1012	984	994	981	1022	954	989
<u>Pseudomonas eisenbergii B994</u>									
3222	974	(915)	996	982	989	981	999	961	989
3223	973	(912)	989	980	986	979	992	963	989
3263	966	(907)	986	977	981	977	988	958	988
3264	975	(919)	989	979	986	980	992	969	988
3808	977	(921)	1013	989	1000	986	1012	974	1001
3809	974	(921)	1004	985	993	984	1006	974	996
3951	972	(916)	1010	982	991	978	1009	962	988
3952	971	(912)	1001	984	989	978	998	963	990

Table 8 (Page 42)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas eisenbergii B995</u>									
3214	942	(890)	981	969	977	967	986	934	987
3215	938	(890)	982	970	981	969	988	938	988
3259	951	(900)	983	971	982	971	990	937	989
3260	951	(891)	981	970	979	969	988	937	988
<u>Pseudomonas eisenbergii B1023</u>									
3351	981	(946)	1016	994	1004	988	1014	978	1013
3352	979	(939)	1017	992	1005	988	1017	978	1014
3377	974	(931)	1008	988	994	982	1006	974	1004
3378	974	(946)	1011	989	997	984	1007	974	1005
<u>Pseudomonas eisenbergii B1245</u>									
3288	956	(907)	976	969	978	970	986	938	985
3289	957	(912)	980	971	981	972	989	943	987
3395	959	(914)	978	969	979	971	986	950	985
3396	960	(906)	980	970	981	973	986	948	986
<u>Pseudomonas fluorescens B10</u>									
3435	(935)	(903)	972	960	970	956	979	947	981
3436	(934)	(896)	971	960	969	953	978	947	981
3458	(925)	(881)	971	958	969	952	978	938	981
3459	(930)	(891)	969	956	968	952	977	937	979
<u>Pseudomonas fluorescens B11</u>									
3063	932	(880)	987	975	985	968	993	954	1008
3106	994	942	1017	1001	1008	997	1018	989	1012
3107	995	965	1016	1001	1006	998	1016	989	1010
3105	994	939	1017	1004	1011	1000	1017	989	1012
3055	(928)	(892)	974	961	977	954	986	939	996
<u>Pseudomonas fluorescens B253</u>									
3108	943	(896)	985	969	982	966	990	949	992
3109	943	(887)	982	969	982	966	989	950	991
3072	964	(887)	990	981	989	979	998	962	1005
3073	966	(892)	990	982	990	981	1000	963	1006
<u>Pseudomonas fluorescens B258</u>									
3421	935	(893)	971	961	971	956	980	940	980
3422	937	(875)	970	960	971	957	978	942	980
3452	946	(891)	976	966	975	964	984	951	979
3453	948	(891)	975	966	975	964	985	951	978

Table 8 (Page 43)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas fluorescens B1244</u>									
3316	984	(952)	1013	994	1016	990	1012	986	1015
3317	987	(930)	1012	998	1007	992	1011	989	1015
3335	990	(932)	1012	999	1008	995	1012	991	1017
3336	990	(937)	1013	1000	1009	995	1012	991	1016
<u>Pseudomonas fragi B25</u>									
3125	943	(892)	979	967	978	962	986	947	987
3126	940	(883)	979	968	979	962	987	943	988
3066	(925)	(869)	971	958	970	953	981	938	985
3065	(926)	(866)	970	960	971	954	981	937	986
<u>Pseudomonas iodina B141</u>									
2840	979	962	1008	996	1000	987	1015	986	996
2841	977	960	1001	991	996	986	1009	985	995
2855	(942)	(920)	982	977	980	972	992	975	1003
2856	(940)	(922)	985	977	980	973	992	976	1004
<u>Pseudomonas iodina B1536</u>									
2994	940	(942)	993	983	987	978	999	979	1003
3015	(938)	(920)	986	977	982	962	992	973	1003
2995	(950)	(930)	989	979	983	972	995	977	1000
3016	(932)	(905)	983	975	980	960	990	971	1001
<u>Pseudomonas iodina B1537</u>									
3028	(928)	(908)	986	975	977	953	991	971	1003
3003	(946)	(922)	988	977	982	963	995	975	1003
3008	(935)	(916)	987	976	981	963	993	974	1007
3004	(947)	(925)	989	980	986	975	996	978	1004
<u>Pseudomonas iodina B1540</u>									
3002	(943)	(927)	985	977	980	960	991	974	1000
3017	(956)	(935)	989	980	985	975	996	979	1004
3019	(951)	(932)	989	979	983	974	996	975	1003
3001	(953)	(937)	990	981	986	975	997	977	1008
<u>Pseudomonas mildenbergii B21</u>									
3114	954	(886)	977	969	976	970	985	942	981
3057	955	(888)	975	969	977	971	985	947	980
3115	953	(892)	977	968	975	969	986	942	981
3056	953	(910)	976	969	976	969	984	948	981

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas mildenbergii B652</u>									
3172	940	(896)	970	957	970	953	978	936	973
3141	941	(896)	968	960	969	959	976	936	975
3173	937	(897)	968	958	970	955	978	935	977
3987	950	(913)	980	971	977	966	986	950	988
3988	957	(912)	982	973	978	969	989	954	983
4006	940	(900)	972	965	974	961	982	940	980
4007	944	(900)	971	966	973	961	980	935	979
<u>Pseudomonas pavonacea B9</u>									
3405	964	(908)	983	974	982	977	989	943	979
3406	967	(912)	986	975	983	977	991	942	977
3445	964	(906)	987	974	981	974	987	949	984
3989	947	(900)	979	970	981	966	990	945	986
3990	950	(905)	981	971	982	965	990	943	986
<u>Pseudomonas pavonacea B259</u>									
3403	975	(925)	1002	986	989	983	996	975	998
3443	979	(930)	1016	992	998	988	1010	979	1009
<u>Pseudomonas putida B13</u>									
3068	936	(875)	974	964	975	959	984	939	986
3130	936	(887)	975	968	975	962	984	941	984
3112	941	(888)	977	967	978	965	984	942	985
3991	968	(912)	1027	987	1004	981	1026	962	1004
3992	965	(907)	1012	982	992	978	1013	959	993
4004	958	(903)	989	978	984	971	992	958	992
4005	966	(912)	994	983	991	976	1012	958	994
<u>Pseudomonas putida B805</u>									
3209	946	(886)	972	962	972	962	979	940	979
3210	949	(887)	975	962	974	960	980	935	977
3190	(925)	(870)	966	955	965	950	976	932	979
3816	970	(903)	1010	987	1005	984	1012	971	1006
3817	975	(900)	1014	989	1007	985	1015	969	1007
3953	936	(860)	985	975	982	967	989	951	991
3954	959	(885)	994	982	990	976	1002	960	1003
<u>Pseudomonas reptilivora B6bs</u>									
3080	946	(875)	974	964	974	963	983	944	979
3088	934	(872)	970	960	971	956	979	934	978
3090	936	(872)	969	959	972	958	980	938	980
3081	949	(878)	975	964	974	965	982	943	978

Table 8 (Page 45)

Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas reptilivora B66</u>									
3494	941	(890)	971	959	972	960	978	935	977
3495	943	(887)	971	960	971	960	980	938	977
3526	941	(883)	972	961	973	961	979	936	977
3531	944	(880)	974	963	972	962	979	938	975
<u>Pseudomonas reptilivora B285</u>									
3101	939	(882)	970	964	972	962	979	938	979
3069	936	(875)	970	960	971	956	979	933	977
3102	943	(890)	972	962	972	962	979	938	978
3071	938	(879)	971	960	972	958	980	933	980
<u>Pseudomonas reptilivora B334</u>									
3169	941	(882)	967	953	967	958	976	930	975
3146	949	(907)	978	969	975	968	986	956	980
3168	935	(884)	965	952	966	954	975	931	975
3147	948	(898)	975	967	975	966	984	952	979
<u>Pseudomonas reptilivora B963</u>									
3022	(917)	(865)	972	956	968	946	979	938	985
2985	(931)	(875)	984	968	977	959	989	952	986
3023	(918)	(865)	976	960	971	952	984	939	983
2984	(930)	(874)	985	970	980	961	991	953	987
<u>Pseudomonas reptilivora B964</u>									
3227	936	(887)	977	968	975	963	985	957	985
3228	(925)	(870)	976	962	972	956	983	951	984
3247	(923)	(873)	982	964	979	955	987	941	990
3248	(925)	(870)	985	970	980	959	989	948	990
<u>Pseudomonas reptilivora B965</u>									
2990	942	(895)	1001	987	991	981	1005	972	999
3032	985	(950)	1016	995	1001	989	1013	986	997
3031	980	(946)	1013	994	997	986	1010	985	996
2991	938	(907)	998	984	990	979	1000	969	998
<u>Pseudomonas stutzeri B775</u>									
3132	944	(900)	982	971	977	966	986	965	987
3159	(923)	(875)	970	957	965	949	976	948	983
3133	970	(914)	1000	984	989	977	1000	975	999
3930	962	(904)	1019	983	993	977	1015	968	998
3931	962	(903)	1018	987	996	977	1018	968	1006
3945	968	(926)	1013	981	990	978	1012	972	997
3946	944	(898)	989	975	980	971	989	960	989

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Curve no.	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5
<u>Pseudomonas stutzeri B927</u>									
3216	981	970	1019	992	1005	989	1016	982	1019
3217	984	971	1022	997	1012	991	1019	982	1018
3310	987	975	1026	1011	1016	995	1023	985	1021
3311	985	971	1027	1013	1017	993	1024	984	1023
3353	974	(942)	1010	988	997	985	1011	976	1010
3354	977	(932)	1014	992	999	989	1013	979	1012
3812	975	(923)	1016	990	1009	986	1014	977	1015
3813	977	(925)	1020	995	1011	988	1016	977	1014
3941	970	(916)	1007	985	995	982	1010	972	1009
3942	970	(930)	1011	988	996	985	1011	973	1014
<u>Pseudomonas suis B1352</u>									
3312	950	(905)	974	959	968	955	977	949	978
3313	951	(903)	975	961	972	957	979	951	978
3329	938	(903)	974	960	971	956	981	947	977
3330	937	(913)	973	959	968	953	978	947	976
<u>Unidentified B29</u>									
3429	941	(874)	982	976	979	969	987	968	992
3430	949	(898)	987	978	983	972	991	968	995
3450	(918)	(858)	982	972	978	959	987	952	993
3451	(921)	(861)	982	973	978	958	987	952	993
<u>Pseudomonas species B1093</u>									
3640	967	(917)	1000	985	990	982	996	973	990
3641	960	(934)	996	985	988	979	995	973	991
3679	955	(910)	985	975	981	974	990	956	979
3680	959	(910)	988	977	984	973	992	951	981
<u>Pseudomonas species B1094</u>									
3306	957	(906)	998	981	990	979	998	959	992
3307	954	(903)	994	978	987	975	995	956	990
3343	962	(917)	1001	983	991	979	997	961	990
3344	968	(916)	1000	985	993	981	999	970	994
<u>Pseudomonas species B1097</u>									
3304	936	(892)	979	967	978	961	986	951	991
3305	947	(895)	984	974	984	967	990	950	995
3363	935	(885)	981	969	980	964	987	952	991
3364	947	(891)	984	973	981	967	989	956	991

Date		Description		Amount		Balance	
Month	Day	Particulars		Dr	Cr	Dr	Cr
1900							
Jan	1	Balance forward					
Jan	2	By Cash					
Jan	3	To Cash					
Jan	4	By Cash					
Jan	5	To Cash					
Jan	6	By Cash					
Jan	7	To Cash					
Jan	8	By Cash					
Jan	9	To Cash					
Jan	10	By Cash					
Jan	11	To Cash					
Jan	12	By Cash					
Jan	13	To Cash					
Jan	14	By Cash					
Jan	15	To Cash					
Jan	16	By Cash					
Jan	17	To Cash					
Jan	18	By Cash					
Jan	19	To Cash					
Jan	20	By Cash					
Jan	21	To Cash					
Jan	22	By Cash					
Jan	23	To Cash					
Jan	24	By Cash					
Jan	25	To Cash					
Jan	26	By Cash					
Jan	27	To Cash					
Jan	28	By Cash					
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Table 8 (Page 47)

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Table 9 (Page 1)

AVERAGE (AV.) AND STANDARD DEVIATION (S.D.) OF TRANSMISSION VALUES
(IN CENTIMICRONS) FOR EACH STRAIN DERIVED FROM THE
DATA IN TABLE 8

Wavelength in microns		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>		<u>Acetobacter aceti</u>									
B578	Av.	1009	995	1034	1013	1011	1004	1017	999	1031	5
	S.D.	4.6	4.0	2.6	2.4	3.6	6.0	3.0	2.8	3.0	
B581	Av.	982	970	1007	989	989	985	1000	987	1013	1
		<u>Acetobacter acetigenum</u>									
B469	Av.	960	(887)	988	975	980	973	991	968	1004	3
	S.D.	5.3	11.4	2.6	2.2	2.0	1.4	1.0	2.0	8.7	
		<u>Acetobacter acetosum</u>									
B468	Av.	962	(895)	992	976	984	974	993	969	1013	2
	S.D.	0.0	14.2	3.6	2.8	1.0	1.0	1.4	1.4	1.4	
B747	Av.	978	(936)	1008	985	990	983	999	979	1011	3
	S.D.	1.4	7.0	6.5	1.0	2.0	1.0	2.4	1.4	4.4	
		<u>Acetobacter acidum-mucosum</u>									
B145	Av.	1018	988	(1058)	1030	1030	1015	1040	1007	1040	1
B1303	Av.	992	973	1038	1005	1008	996	1017	990	1024	2
	S.D.	5.6	4.2	6.5	7.0	6.5	3.6	4.2	0.0	1.0	
		<u>Acetobacter ascendens</u>									
B56	Av.	971	(921)	1011	988	991	984	1004	980	1018	2
	S.D.	0.0	24.0	4.2	2.8	1.4	1.4	5.0	1.0	2.2	
B1047	Av.	988	952	1021	994	995	990	1001	988	1014	2
	S.D.	1.0	2.8	4.2	1.0	0.0	0.0	1.4	1.0	1.0	
		<u>Acetobacter capsulatum</u>									
B1225	Av.	989	946	1021	996	998	993	1014	990	1020	1
		<u>Acetobacter gluconicum</u>									
B64	Av.	970	940	991	983	985	976	992	985	996	1
B471	Av.	964	(902)	996	982	986	977	994	968	998	2
	S.D.	5.6	2.2	1.0	2.2	2.8	2.8	1.0	1.0	1.4	

Table 9 (Page 2)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Acetobacter ketogenum</u>									
B999	: Av.	979	(939)	1011	988	992	986	1008	983	1016	5
	: S.D.	1.4	1.4	1.4	2.4	3.0	1.7	2.2	1.4	1.4	
	:	<u>Acetobacter melanogenum</u>									
B63	: Av.	952	(894)	982	967	976	966	985	955	988	2
	: S.D.	2.8	1.4	0.0	0.0	1.0	1.4	1.4	1.4	1.0	
	:	<u>Acetobacter mobile</u>									
B146	: Av.	966	(908)	996	980	985	978	995	968	1010	2
	: S.D.	2.8	9.2	2.2	2.2	1.4	1.4	0.0	2.2	1.0	
	:	<u>Acetobacter orleanse</u>									
B55	: Av.	986	(916)	1024	997	1008	989	1021	979	1032	3
	: S.D.	10.1	6.5	6.7	13.9	8.2	5.0	4.0	1.4	4.7	
	:	<u>Acetobacter oxydans</u>									
B147	: Av.	984	943	1028	996	1000	990	1018	990	1030	2
	: S.D.	3.6	2.8	3.6	1.0	1.0	0.0	2.2	1.0	1.0	
	:	<u>Acetobacter pasteurianum</u>									
B752	: Av.	945	(883)	986	974	979	968	986	961	995	3
	: S.D.	3.2	6.6	1.4	1.4	1.0	2.0	2.0	1.4	1.4	
	:	<u>Acetobacter rancens</u>									
B65	: Av.	995	973	1030	1007	1012	999	1019	996	1032	3
	: S.D.	1.4	1.0	5.6	5.1	3.2	4.0	3.6	1.7	5.8	
B754	: Av.	994	971	1029	1005	1012	998	1016	995	1025	3
	: S.D.	4.5	3.6	6.2	9.1	2.6	6.1	5.6	5.0	4.1	
	:	<u>Acetobacter suboxydans</u>									
B72	: Av.	990	956	1040	1002	1005	993	1025	992	1035	2
	: S.D.	5.0	7.1	9.9	9.2	9.9	4.3	8.5	2.8	7.8	
B177	: Av.	973	(925)	1006	985	989	982	999	978	1012	2
	: S.D.	2.8	5.6	12.0	3.6	4.3	2.8	5.0	2.2	5.6	

Table 9 (Page 3)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Acetobacter turbidans</u>									
B570	: Av.	964	(899)	1004	978	986	977	1016	966	1022	2
	: S.D.	6.4	1.4	15.5	2.2	5.0	1.4	2.2	1.0	1.0	
B1026	: Av.	992	972	1028	1000	1006	994	1017	990	1032	4
	: S.D.	3.0	2.0	7.9	5.1	8.2	2.4	5.2	1.4	5.5	
	:	<u>Acetobacter xylinoides</u>									
B1034	: Av.	989	963	1015	998	1002	993	1012	989	1016	1
	:	<u>Acetobacter xylinum</u>									
B42	: Av.	1011	999	1036	1016	1014	1007	1020	1006	1032	5
	: S.D.	7.7	8.4	9.8	5.7	4.7	6.9	4.0	6.1	2.4	
B43	: Av.	(910)	(882)	970	958	966	942	976	936	986	2
	: S.D.	2.8	30.4	3.6	6.4	3.6	7.1	3.6	2.2	1.4	
	:	<u>Achromobacter ammoniagenes</u>									
B1323	: Av.	960	(895)	989	975	980	974	988	970	992	2
	: S.D.	6.4	18.4	4.2	2.8	2.2	2.2	2.2	2.8	2.2	
	:	<u>Achromobacter lacticum</u>									
B551	: Av.	980	(934)	1019	994	1000	990	1016	983	1026	3
	: S.D.	5.2	9.5	5.1	7.2	12.9	3.5	4.0	2.4	7.2	
B552	: Av.	932	(896)	982	966	971	960	983	952	986	2
	: S.D.	2.8	13.4	2.8	3.6	2.8	4.2	2.2	1.0	2.2	
	:	<u>Aerobacter aerogenes</u>									
B199	: Av.	955	(921)	996	983	987	976	997	977	1013	5
	: S.D.	16.6	26.9	9.7	5.3	6.1	7.4	8.9	5.6	2.4	
B562	: Av.	974	(954)	1016	986	989	980	1008	984	1023	2
	: S.D.	1.0	6.4	2.8	1.0	0.0	1.0	3.6	1.0	1.4	
	:	<u>Aerobacter cloacae</u>									
B126	: Av.	984	(953)	1008	996	999	990	1004	990	1018	2
	: S.D.	1.0	4.2	3.6	2.8	1.4	2.2	2.8	2.8	7.8	
B169	: Av.	944	(893)	990	978	982	972	990	964	1002	2
	: S.D.	1.0	7.1	5.0	5.0	3.6	3.6	6.4	1.4	12.0	

Table 9 (Page 4)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Aeromonas hydrophila</u>									
B909	: Av.	(934)	(907)	981	970	979	959	986	956	986	3
	: S.D.	5.1	13.0	2.4	4.0	2.4	1.7	1.4	1.0	2.4	
B910	: Av.	933	(897)	985	976	983	964	991	960	992	3
	: S.D.	1.4	10.6	1.4	1.7	2.7	2.4	3.2	3.6	2.4	
	:	<u>Aeromonas ichthyosmia</u>									
B926	: Av.	(922)	(882)	971	957	968	950	982	944	990	2
	: S.D.	3.6	12.0	1.4	2.8	2.8	1.0	2.2	1.0	2.2	
	:	<u>Aeromonas punctata</u>									
B914	: Av.	(918)	(876)	958	944	952	923	969	926	979	2
	: S.D.	1.4	2.2	3.6	1.0	2.8	4.3	2.8	2.2	2.2	
	:	<u>Aeromonas salmonicida</u>									
B1465	: Av.	(913)	(840)	973	954	969	936	978	937	987	1
	:	<u>Aeromonas species</u>									
B538	: Av.	936	(908)	975	964	973	958	983	945	987	4
	: S.D.	7.5	12.0	3.0	3.6	1.7	4.9	1.4	6.4	1.4	
	:	<u>Agrobacterium radiobacter</u>									
B164	: Av.	959	(937)	1000	986	989	975	1000	984	1008	2
	: S.D.	1.4	4.3	2.2	2.2	1.4	5.6	1.0	1.4	0.0	
B181	: Av.	950	(914)	991	977	983	968	994	963	1001	2
	: S.D.	8.5	7.1	4.3	7.8	5.7	7.8	5.7	5.7	5.0	
	:	<u>Agrobacterium rhizogenes</u>									
B193	: Av.	940	(881)	994	985	987	976	994	968	1010	1
	:	<u>Agrobacterium tumefaciens</u>									
B36	: Av.	964	(940)	1003	988	992	981	1002	984	1006	2
	: S.D.	6.4	3.6	4.3	4.3	5.0	5.0	3.6	1.0	3.6	
B37	: Av.	947	(914)	996	980	986	971	996	973	1004	2
	: S.D.	9.9	6.4	6.4	5.0	4.2	7.0	5.0	2.8	4.2	

Table 9 (Page 5)

Wavelength in microns		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>											
				<u>Alcaligenes faecalis</u>							
B170	Av.	(930)	(876)	972	959	969	956	976	938	980	2
	S.D.	5.0	7.0	3.6	4.2	5.6	5.0	5.0	7.8	3.6	
				<u>Alcaligenes viscosus</u>							
B182	Av.	958	(945)	996	982	985	976	996	984	1007	4
	S.D.	20.4	16.6	17.0	10.2	10.6	14.0	13.9	10.3	10.3	
				<u>Arthrobacter citreus</u>							
B1258	Av.	971	(950)	1013	993	1001	980	1012	1009	1026	3
	S.D.	4.0	5.0	2.4	14.8	12.8	3.2	2.0	1.0	1.4	
				<u>Azotobacter chroococcum</u>							
B488	Av.	(950)	(949)	973	967	966	(956)	977	966	988	2
	S.D.	1.0	0.0	1.4	1.4	1.4	1.0	2.8	1.4	1	
				<u>Bacillus alvei</u>							
B383	Av.	956	(921)	994	982	987	975	998	984	1000	3
	S.D.	12.6	12.4	13.2	7.0	4.9	5.0	9.9	3.8	8.1	
B385	Av.	(936)	(915)	991	978	980	960	990	976	1000	9
	S.D.	2.6	8.5	10.2	7.4	7.4	5.5	4.9	5.6	6.0	
B386	Av.	(924)	(890)	980	964	971	952	984	963	991	3
	S.D.	18.2	10.3	10.0	12.7	8.9	17.6	8.9	14.7	6.7	
				<u>Bacillus circulans</u>							
B378	Av.	(921)	(884)	973	961	967	943	979	956	989	8
	S.D.	9.0	15.5	7.5	7.1	4.4	8.6	4.7	9.3	4.2	
NRS831	Av.	974	(948)	1002	990	993	982	1003	976	991	2
	S.D.	12.0	18.4	10.6	6.4	4.2	7.1	8.5	8.5	7.1	
NRS1136	Av.	937	(908)	991	979	980	964	992	981	1002	4
	S.D.	1.7	11.7	2.6	4.2	4.6	4.4	2.8	3.7	5.6	
				<u>Bacillus coagulans</u>							
NRST13	Av.	981	(941)	1007	993	996	988	1007	978	998	4
	S.D.	13.1	25.9	11.1	9.0	7.5	5.8	7.4	7.1	1.7	

Table 9 (Page 6)

Wavelength in microns		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>		<u>Bacillus coagulans</u> (Cont'd.)									
NRS795	Av.	972	(940)	1011	998	1001	986	1010	978	1009	3
	S.D.	6.2	8.5	6.0	5.8	7.0	4.6	4.7	1.7	3.3	
NRS796	Av.	970	(947)	1000	991	994	982	1004	975	1004	4
	S.D.	4.8	5.8	4.4	3.2	2.0	2.6	5.6	3.9	1.4	
		<u>Bacillus firmus</u>									
NRS855	Av.	969	935	999	988	988	977	1000	984	1000	1
NRS858	Av.	(927)	(906)	977	967	970	950	982	958	997	5
	S.D.	3.2	7.2	6.4	5.4	6.0	7.7	6.1	6.2	8.7	
		<u>Bacillus laterosporus</u>									
NRS314	Av.	(907)	(866)	953	935	952	(926)	962	(934)	974	2
	S.D.	5.0	6.4	2.8	5.6	2.8	2.2	2.2	2.8	0.0	
NRS340	Av.	(920)	(881)	966	953	964	(940)	973	(942)	979	4
	S.D.	19.5	21.8	17.0	20.8	16.1	19.9	12.9	11.8	5.0	
NRS347	Av.	(918)	(883)	960	950	960	(936)	970	931	978	2
	S.D.	1.4	0.0	1.0	0.0	0.0	1.4	1.0	1.4	1.0	
NRS590	Av.	(922)	(881)	970	959	967	944	977	947	984	3
	S.D.	8.9	13.1	5.2	5.8	4.0	8.6	3.7	8.5	1.0	
		<u>Bacillus lentus</u>									
B396	Av.	930	(898)	985	976	977	965	986	961	990	1
NRS883	Av.	(939)	(905)	991	980	984	968	922	959	1004	2
	S.D.	7.1	2.8	1.4	0.0	1.0	2.8	1.0	4.2	7.8	
		<u>Bacillus licheniformis</u>									
B1001	Av.	(914)	(888)	985	974	979	944	986	966	998	4
	S.D.	8.4	12.5	5.0	6.0	4.6	11.2	4.4	4.6	3.7	
NRS1263	Av.	(933)	(903)	989	980	985	958	990	971	1002	4
	S.D.	3.6	2.2	3.0	2.4	3.2	4.4	3.2	2.2	3.7	
NRS1264	Av.	(918)	(880)	980	969	974	947	983	958	994	4
	S.D.	5.9	10.1	2.0	2.6	1.7	2.4	1.7	2.6	1.0	

Table 9 (Page 7)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Bacillus macerans</u>									
B172	: Av.	(905)	(888)	968	964	969	(938)	973	960	983	6
	: S.D.	20.0	23.2	1.0	9.0	1.7	12.3	2.0	1.0	2.6	
NRS1093	: Av.	(942)	(910)	987	977	983	965	991	964	995	3
	: S.D.	11.1	41.8	6.8	6.5	6.8	7.6	7.9	5.3	5.2	
NRS1045	: Av.	(944)	(915)	988	980	986	966	992	968	999	2
	: S.D.	2.2	0.0	2.2	1.0	2.8	2.8	3.6	1.0	1.0	
	:	<u>Bacillus megaterium</u>									
NRS308	: Av.	(938)	(928)	990	977	978	958	988	975	1002	4
	: S.D.	10.0	10.9	3.3	2.0	1.7	4.4	1.7	2.0	1.7	
NRS350	: Av.	(941)	(930)	992	982	984	960	990	982	1005	4
	: S.D.	3.0	3.0	1.0	1.4	1.0	2.6	1.0	1.0	1.4	
NRS351	: Av.	(922)	(899)	981	971	975	938	984	965	999	4
	: S.D.	2.8	7.4	0.0	1.4	1.0	1.7	1.0	1.0	1.7	
NRS607	: Av.	(954)	(946)	996	986	988	978	998	978	1006	4
	: S.D.	3.9	4.6	3.9	2.0	1.4	1.4	3.0	3.0	4.9	
NRS608	: Av.	(964)	(946)	1006	993	994	980	1000	992	1009	4
	: S.D.	8.9	12.4	6.0	2.6	2.6	5.8	3.3	1.4	2.4	
NRS610	: Av.	945	(934)	1006	990	992	980	1004	979	1010	4
	: S.D.	17.8	6.6	3.6	0.8	1.0	0.8	2.7	0.8	1.3	
NRS623	: Av.	(957)	(942)	1001	988	994	977	1000	981	1011	4
	: S.D.	4.7	7.3	2.2	1.8	1.8	1.8	2.6	1.9	1.5	
NRS627	: Av.	(942)	(935)	1002	986	988	(966)	998	985	1008	4
	: S.D.	16.9	16.5	10.7	8.9	8.2	14.0	9.7	6.4	2.2	
NRS822	: Av.	(948)	(934)	991	983	985	974	994	974	1007	4
	: S.D.	3.9	7.1	2.8	2.4	2.4	2.8	2.8	3.0	1.7	
NRS824	: Av.	(954)	(947)	994	986	987	977	996	978	1008	4
	: S.D.	1.4	8.5	3.6	2.0	2.2	2.6	2.2	2.4	4.1	
NRS828	: Av.	(946)	(956)	1005	992	994	982	1002	986	1012	4
	: S.D.	19.5	5.8	6.2	4.0	4.4	3.7	5.1	2.6	3.6	
NRS829	: Av.	960	(959)	1008	996	997	984	1002	992	1014	4
	: S.D.	20.0	20.1	3.0	1.7	2.2	1.7	2.6	1.4	1.7	

Table 9 (Page 8)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Bacillus megaterium</u> (Cont'd.)									
NRS835	: Av.	(944)	(941)	1004	989	993	978	1002	979	1008	4
	: S.D.	13.0	4.9	2.0	2.4	1.4	1.4	2.4	1.4	2.4	
NRS837	: Av.	(930)	(936)	1004	989	993	977	1002	977	1011	4
	: S.D.	2.6	1.4	2.2	1.0	2.0	1.7	1.0	2.0	1.4	
NRS872	: Av.	(942)	(938)	999	984	985	(960)	994	981	1012	4
	: S.D.	12.4	14.8	2.2	1.0	1.4	6.6	1.0	1.4	13.1	
NRS892	: Av.	(942)	(928)	988	978	980	967	989	968	995	4
	: S.D.	6.1	4.4	2.8	2.2	2.0	2.2	3.0	1.0	3.0	
NRS895	: Av.	(940)	(934)	(994)	980	984	963	994	977	1007	4
	: S.D.	3.9	5.3	2.6	1.0	2.2	2.2	1.7	2.6	2.4	
NRS907	: Av.	(960)	(948)	1004	990	994	978	1000	982	1012	4
	: S.D.	3.3	2.8	2.2	2.1	2.4	1.7	1.9	1.3	1.7	
NRS923	: Av.	(943)	(934)	1008	990	991	(967)	999	986	1009	4
	: S.D.	15.3	8.3	20.4	12.7	12.4	10.4	12.6	6.5	3.8	
NRS931	: Av.	(940)	(916)	987	976	982	964	991	962	1004	4
	: S.D.	12.5	14.2	5.6	5.4	5.4	9.6	8.3	3.7	2.4	
	:	<u>Bacillus pantothenicus</u>									
NRS1317	: Av.	949	(924)	998	989	991	978	1000	970	1006	2
	: S.D.	26.8	18.4	8.5	7.1	5.7	9.2	6.4	11.3	12.7	
NRS1318	: Av.	963	(922)	990	978	986	976	994	954	985	4
	: S.D.	10.8	14.9	7.1	7.3	5.5	6.9	5.8	9.3	1.0	
NRS1319	: Av.	(953)	(920)	997	983	986	974	1002	969	995	3
	: S.D.	17.6	12.4	8.9	8.7	8.1	11.0	10.4	7.2	1.2	
NRS1320	: Av.	(964)	(933)	1016	992	995	981	1013	971	1005	5
	: S.D.	29.0	34.2	29.8	12.3	12.2	17.2	21.0	13.1	4.0	
	:	<u>Bacillus polymyxa</u>									
B174	: Av.	(926)	(884)	977	969	974	952	984	955	991	4
	: S.D.	11.0	6.8	6.3	6.5	6.5	10.9	6.8	6.6	5.2	
B368	: Av.	(946)	(914)	981	976	980	964	988	962	986	3
	: S.D.	15.0	20.0	8.1	8.4	7.8	10.4	8.7	13.0	1.2	

Table 9 (Page 9)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Bacillus polymyxa</u> (Cont'd.)									
B372	: Av.	(924)	(889)	975	966	974	950	982	962	989	4
	: S.D.	12.2	21.2	4.5	5.3	4.4	12.6	3.6	8.4	0.8	
NRS1105	: Av.	(915)	(885)	975	965	972	946	982	952	991	4
	: S.D.	3.3	6.9	1.4	3.0	1.6	2.2	1.4	5.8	1.8	
	:	<u>Bacillus pulvifaciens</u>									
NRS1284	: Av.	(924)	(878)	974	968	973	946	980	952	992	2
	: S.D.	5.6	16.3	1.4	1.0	1.4	1.0	2.2	2.2	2.8	
NRS1285	: Av.	958	(935)	998	988	991	972	998	981	998	2
	: S.D.	1.0	0.0	0.0	1.0	0.0	1.4	1.0	1.4	1.0	
	:	<u>Bacillus pumilus</u>									
NRS272	: Av.	(916)	(889)	977	968	973	(944)	981	961	993	4
	: S.D.	6.9	10.1	2.3	1.5	1.5	2.6	1.3	2.5	1.4	
NRS630	: Av.	(923)	(894)	980	969	974	(947)	982	960	994	3
	: S.D.	7.1	11.4	4.7	5.2	4.7	5.0	3.6	3.6	1.4	
NRS939	: Av.	(920)	(897)	978	966	971	(944)	983	961	994	6
	: S.D.	14.0	16.8	6.1	9.2	6.9	8.6	4.8	8.9	1.9	
B1489	: Av.	(932)	(910)	982	976	977	954	986	962	997	4
	: S.D.	6.5	11.3	3.5	3.9	2.4	8.5	2.8	3.3	1.6	
	:	<u>Bacillus sphaericus</u>									
NRST156	: Av.	(926)	(879)	971	961	968	950	980	960	983	4
	: S.D.	20.7	23.5	10.0	12.4	9.6	15.6	6.4	8.2	1.3	
NRS344	: Av.	(924)	(869)	977	967	973	952	982	961	986	4
	: S.D.	3.3	13.4	5.0	3.3	2.9	2.7	2.9	4.0	2.6	
NRS348	: Av.	(912)	(862)	977	962	970	946	981	954	987	4
	: S.D.	8.0	11.0	6.0	7.4	5.7	8.3	4.9	6.2	3.9	
NRS966	: Av.	(903)	(864)	968	950	962	(932)	979	946	990	4
	: S.D.	8.4	22.4	2.4	4.1	2.6	2.4	0.8	8.7	2.0	
	:	<u>Bacillus subtilis</u>									
B543	: Av.	(916)	(870)	986	978	980	956	989	966	998	4
	: S.D.	8.4	12.4	2.0	1.6	3.0	1.7	1.5	2.4	1.4	

Table 9 (Page 10)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Bacillus subtilis</u> (Cont'd.)									
B558	: Av.	(950)	(927)	1000	992	996	974	1000	982	1008	4
	: S.D.	6.8	7.4	3.7	2.6	2.2	4.2	2.6	2.4	2.2	
NRS743	: Av.	(929)	(886)	990	979	982	960	995	964	996	4
	: S.D.	9.4	4.9	1.1	1.0	2.4	3.3	0.0	0.5	1.4	
NRS744	: Av.	(901)	(869)	985	973	979	948	987	968	1000	3
	: S.D.	7.4	11.8	3.5	3.2	2.1	4.6	2.6	5.2	0.7	
B765	: Av.	(928)	(893)	988	980	984	959	989	968	997	4
	: S.D.	8.5	14.1	5.3	5.0	6.8	4.9	3.6	6.6	1.5	
B971	: Av.	(917)	(870)	984	976	981	954	987	966	998	4
	: S.D.	13.5	20.5	5.4	4.4	5.0	8.3	2.8	1.7	2.9	
	:	<u>Bacillus subtilis</u> variety <u>aterrimus</u>									
B362	: Av.	(909)	(862)	985	976	980	951	987	966	997	4
	: S.D.	13.1	22.0	2.1	1.7	2.2	5.9	1.7	2.1	1.5	
NRS653	: Av.	(922)	(858)	987	978	983	960	990	968	996	4
	: S.D.	8.1	23.3	2.4	2.5	1.5	4.5	2.0	3.0	1.8	
NRS659	: Av.	(892)	(841)	981	971	976	942	986	962	997	4
	: S.D.	1.4	13.9	1.5	2.2	3.1	4.4	2.0	3.9	1.6	
NRS740	: Av.	(918)	(858)	988	978	981	959	990	965	995	6
	: S.D.	20.7	31.2	2.2	3.4	3.4	9.4	2.6	5.8	0.5	
	:	<u>Bacillus subtilis</u> variety <u>niger</u>									
NRS264	: Av.	(926)	(880)	988	979	982	965	990	973	1000	4
	: S.D.	2.2	13.5	2.2	0.8	1.3	1.7	0.8	1.0	1.9	
B364	: Av.	(924)	(872)	988	980	983	965	990	972	1001	4
	: S.D.	6.2	4.7	2.7	2.6	1.5	1.8	2.9	2.1	2.2	
NRS650	: Av.	(911)	(862)	982	972	976	952	986	966	996	4
	: S.D.	11.0	16.8	1.4	1.3	1.8	3.5	2.2	2.9	1.5	
NRS651	: Av.	(926)	(888)	989	978	982	962	991	973	1002	4
	: S.D.	7.9	13.5	3.2	2.9	2.9	4.8	1.8	1.7	1.8	

Table 9 (Page 11)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Bacillus technicus</u>									
B675	: Av.	(930)	(915)	988	978	983	960	989	970	996	4
	: S.D.	10.7	8.2	1.7	2.2	2.6	3.2	1.8	3.3	1.5	
	:	<u>Bacterium stewartii</u>									
B28	: Av.	(933)	(892)	988	978	981	957	991	968	1003	3
	: S.D.	0.0	6.7	6.2	7.0	2.8	4.4	3.7	11.2	7.2	
B158	: Av.	938	(899)	990	982	984	966	992	978	1002	2
	: S.D.	2.8	1.4	1.0	2.8	2.2	8.5	1.4	9.2	2.4	
	:	<u>Brucella bronchiseptica</u>									
B140	: Av.	(926)	(876)	962	946	960	943	972	933	980	2
	: S.D.	5.0	14.1	5.6	4.2	4.2	5.6	2.4	5.6	2.4	
	:	<u>Cellulomonas biazotea</u>									
B401	: Av.	948	(916)	1016	982	986	974	1016	974	1034	2
	: S.D.	12.7	9.9	1.0	1.0	2.2	1.4	1.0	1.0	6.4	
	:	<u>Cellulomonas udum</u>									
B404	: Av.	980	972	1018	1007	1007	986	1016	1004	1024	2
	: S.D.	2.8	2.2	0.0	2.8	2.8	2.8	1.0	5.6	2.2	
	:	<u>Chromobacterium violaceum</u>									
B1020	: Av.	932	(900)	967	956	966	952	976	946	980	4
	: S.D.	5.5	13.2	2.6	2.2	3.6	3.2	4.7	3.8	1.7	
	:	<u>Corynebacterium fascians</u>									
B190	: Av.	(958)	(913)	1012	988	1001	978	1009	984	1048	2
	: S.D.	20.5	38.2	9.2	11.3	15.5	9.2	12.7	6.4	8.5	
	:	<u>Corynebacterium fimi</u>									
B402	: Av.	960	(927)	998	985	988	976	997	976	1030	2
	: S.D.	1.0	1.4	3.6	0.0	1.0	2.2	4.2	2.8	8.5	
B403	: Av.	974	(938)	1034	1018	1022	988	1030	986	1040	2
	: S.D.	1.0	14.8	1.4	2.2	2.2	0.0	2.2	3.6	1.0	

Table 9 (Page 12)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Corynebacterium flaccumfaciens</u>									
B729	: Av.	988	970	1032	1017	1019	1012	1024	1011	1034	3
	: S.D.	2.6	4.7	1.4	1.0	1.4	1.4	1.0	2.4	1.4	
	:	<u>Corynebacterium michiganense</u>									
B33	: Av.	984	932	1024	1010	1013	994	1016	990	1036	2
	: S.D.	3.6	3.6	1.4	1.0	1.4	3.6	2.2	2.2	1.4	
	:	<u>Corynebacterium xerose</u>									
B1379	: Av.	(927)	(885)	988	970	980	952	990	960	1026	8
	: S.D.	7.9	12.1	6.9	5.5	4.8	3.9	4.0	8.1	12.0	
	:	<u>Cytophaga hutchinsoniae</u>									
B216	: Av.	(931)	(901)	984	970	974	963	986	967	1014	3
	: S.D.	11.0	3.5	1.0	1.0	0.0	1.4	1.4	1.0	1.4	
	:	<u>Erwinia amylovora</u>									
B127	: Av.	(929)	(862)	980	970	976	959	985	959	994	6
	: S.D.	3.3	11.6	3.7	8.9	3.2	5.2	2.6	9.9	5.7	
B405	: Av.	(961)	(905)	989	977	982	975	989	952	988	3
	: S.D.	4.9	4.5	4.7	3.5	3.2	2.8	3.6	2.8	2.4	
	:	<u>Erwinia carotovora</u>									
B422	: Av.	(930)	(920)	976	962	970	946	981	956	994	3
	: S.D.	14.2	7.2	4.2	7.6	5.1	11.6	4.0	17.2	4.6	
	:	<u>Escherichia coli</u>									
B210	: Av.	964	(911)	1005	990	995	983	1005	981	1013	3
	: S.D.	13.6	26.4	6.6	7.0	7.7	5.8	6.2	6.5	4.7	
B281	: Av.	(950)	(906)	993	980	985	962	996	969	1008	7
	: S.D.	25.1	36.4	16.0	12.6	13.7	24.1	13.0	13.6	9.4	
	:	<u>Flavobacterium aurantiacum</u>									
B184	: Av.	971	(919)	1024	996	1005	985	1019	985	1047	3
	: S.D.	6.4	9.5	15.8	7.0	9.0	5.3	16.7	2.6	11.1	

Table 9 (Page 13)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Flavobacterium devorans</u>									
B54	: Av.	(926)	(880)	971	952	961	945	973	947	980	3
	: S.D.	4.9	9.5	2.0	2.0	1.4	4.4	1.7	2.2	0.0	
	:	<u>Flavobacterium sulfureum</u>									
B185	: Av.	(949)	(923)	986	975	979	966	987	970	998	3
	: S.D.	6.8	10.7	5.5	8.2	7.0	5.3	2.8	8.1	12.4	
	:	<u>Micrococcus conglomeratus</u>									
B635	: Av.	(935)	(898)	982	973	978	952	986	943	998	6
	: S.D.	13.2	24.5	1.4	1.0	1.0	3.3	1.0	5.7	2.0	
	:	<u>Micrococcus lysodeikticus</u>									
B287	: Av.	(948)	(930)	1011	983	989	969	1007	979	1028	8
	: S.D.	3.2	6.8	3.2	5.5	5.5	3.7	6.6	3.3	5.4	
	:	<u>Micrococcus pyogenes</u>									
B1317	: Av.	(939)	(903)	988	979	982	959	991	952	996	5
	: S.D.	11.1	19.4	8.7	10.3	8.3	10.4	9.6	6.15	5.9	
B1318	: Av.	(944)	(911)	990	980	985	966	992	956	997	6
	: S.D.	2.8	8.6	2.0	2.4	2.2	2.6	1.7	2.4	2.4	
B1317	: Av.	(939)	(915)	979	970	975	953	987	949	991	1
	:	<u>Micrococcus roseus</u>									
B245	: Av.	1015	1009	1031	1020	1020	1015	1020	1019	1032	3
	: S.D.	0.7	1.0	2.4	0.7	0.7	0.0	0.0	0.7	1.7	
	:	<u>Micrococcus subcitreus</u>									
B186	: Av.	(937)	(918)	1004	983	984	969	996	982	1019	5
	: S.D.	8.9	14.9	6.8	2.2	1.7	2.4	5.5	1.4	1.4	
	:	<u>Micrococcus species</u>									
B911	: Av.	944	(906)	988	978	982	973	993	963	1000	2
	: S.D.	9.2	4.2	2.2	2.2	2.8	1.4	2.8	0.0	2.7	
B916	: Av.	966	(934)	994	985	992	978	999	968	1000	6
	: S.D.	4.6	15.7	2.8	2.4	2.4	2.2	2.4	3.6	2.4	

Table 9 (Page 14)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Mycobacterium smegmatis</u>									
B612	: Av.	941	(892)	984	971	980	963	986	956	988	6
	: S.D.	5.7	7.8	4.2	4.0	3.4	4.1	2.6	1.7	2.2	
	:	<u>Nersseria perflava</u>									
B1458	: Av.	(900)	(850)	945	931	948	(930)	962	(928)	976	2
	: S.D.	2.8	12.0	0.0	1.4	1.0	1.0	1.4	3.6	3.6	
	:	<u>Nocardia coeliaca</u>									
B1365	: Av.	(932)	(904)	980	970	976	(951)	984	958	996	6
	: S.D.	10.6	20.9	1.7	2.2	1.7	4.7	1.4	1.7	1.7	
	:	<u>Nocardia erythropoles</u>									
B1532	: Av.	940	(920)	1004	976	986	972	1010	975	1033	3
	: S.D.	14.1	21.2	9.2	1.4	2.8	2.2	1.0	0.0	0.0	
	:	<u>Nocardia globerula</u>									
B1306	: Av.	(933)	(903)	984	970	981	955	991	957	1022	6
	: S.D.	4.9	17.5	1.8	1.3	2.0	3.1	2.4	2.5	8.8	
	:	<u>Nocardia polychromogenes</u>									
B1531	: Av.	974	(939)	1025	999	1012	989	1020	998	1046	3
	: S.D.	8.5	9.6	7.6	7.0	4.0	5.5	4.3	6.1	4.0	
	:	<u>Proteus ammoniae</u>									
B420	: Av.	(923)	(864)	979	966	973	950	986	948	999	6
	: S.D.	5.5	13.3	4.5	6.7	6.4	5.0	3.7	3.9	9.5	
	:	<u>Proteus anindologenes</u>									
B418	: Av.	(929)	(883)	979	967	972	951	983	951	1000	5
	: S.D.	5.4	14.3	4.0	5.6	5.6	8.9	3.9	3.7	5.9	
	:	<u>Proteus mirabilis</u>									
B400	: Av.	(915)	(874)	967	951	957	(934)	975	932	986	5
	: S.D.	11.9	35.4	1.4	2.4	2.0	5.9	3.5	2.6	1.0	

Table 9 (Page 15)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Proteus morganii</u>									
B540	: Av.	(927)	(877)	971	961	968	953	978	936	988	6
	: S.D.	4.6	14.4	2.2	2.4	1.7	10.6	2.2	2.0	1.4	
	:	<u>Proteus vulgaris</u>									
B123	: Av.	(942)	(892)	981	972	976	962	986	947	994	6
	: S.D.	5.6	16.8	2.0	2.2	2.4	2.6	1.4	2.8	1.4	
B415	: Av.	(921)	(846)	975	958	967	938	981	935	991	3
	: S.D.	3.8	33.3	4.1	3.5	4.2	7.5	2.1	2.1	2.6	
	:	<u>Pseudomonas acidovorans</u>									
B802	: Av.	950	(888)	983	970	979	967	987	956	988	7
	: S.D.	6.3	17.8	6.1	5.4	4.3	5.9	4.0	4.8	1.7	
B819	: Av.	(937)	(883)	976	962	974	959	983	954	987	4
	: S.D.	6.0	20.2	2.9	5.6	2.2	5.0	2.2	6.5	2.1	
	:	<u>Pseudomonas aeruginosa</u>									
B7	: Av.	(947)	(891)	982	972	981	967	990	948	990	4
	: S.D.	10.2	10.3	5.9	9.5	7.8	8.4	6.4	7.3	2.4	
B12	: Av.	952	(922)	990	977	986	972	995	959	993	5
	: S.D.	8.1	19.5	1.9	4.5	4.1	4.9	2.4	4.4	2.2	
B23	: Av.	(932)	(887)	982	969	976	963	987	958	990	4
	: S.D.	14.8	25.3	3.7	6.2	5.8	7.6	3.3	3.2	1.6	
B26	: Av.	(930)	(882)	984	969	978	962	988	949	989	4
	: S.D.	4.1	4.6	1.1	1.2	3.2	1.6	2.5	2.5	3.2	
B27	: Av.	(939)	(900)	982	970	978	962	988	952	989	4
	: S.D.	5.1	6.3	1.8	1.5	2.4	5.0	1.4	3.6	1.0	
B79	: Av.	(937)	(888)	982	970	976	964	986	957	988	4
	: S.D.	6.6	6.6	1.7	2.6	2.2	2.6	1.5	3.6	0.8	
B189	: Av.	934	(896)	979	969	976	964	983	955	985	4
	: S.D.	4.9	5.5	1.6	1.0	1.1	0.8	1.4	0.6	1.0	
B211	: Av.	956	(896)	989	977	984	972	992	963	992	4
	: S.D.	1.8	8.8	3.4	2.4	2.4	1.5	2.2	4.0	2.2	

Table 9 (Page 16)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas aeruginosa</u> (Cont'd.)									
B217	: Av.	(950)	(905)	988	977	984	969	992	958	991	3
	: S.D.	17.1	23.4	2.9	4.1	3.1	6.1	2.6	9.3	0.7	
B218	: Av.	(936)	(878)	980	967	975	961	984	952	984	4
	: S.D.	8.9	9.5	5.1	4.0	3.3	5.2	2.7	4.9	1.0	
B219	: Av.	(934)	(872)	982	968	976	960	985	953	988	4
	: S.D.	4.2	7.1	1.1	1.0	1.8	1.4	1.3	2.2	1.3	
B220	: Av.	949	(902)	987	975	982	970	989	962	988	4
	: S.D.	11.9	4.4	5.0	4.2	4.2	3.8	4.4	4.7	3.2	
B221	: Av.	938	(894)	983	970	978	966	985	957	984	4
	: S.D.	6.6	5.3	1.4	1.4	2.2	2.2	0.8	2.2	1.4	
B241	: Av.	(934)	(888)	976	965	973	957	984	948	987	4
	: S.D.	5.2	11.3	1.7	1.5	1.5	3.3	2.8	4.6	1.7	
B247	: Av.	(938)	(884)	980	968	976	962	987	954	988	4
	: S.D.	2.6	1.1	2.2	2.2	2.6	1.8	2.2	2.0	1.3	
B248	: Av.	(927)	(873)	978	964	972	957	983	950	984	4
	: S.D.	6.1	21.8	3.2	2.9	2.4	5.8	2.3	3.7	0.8	
B249	: Av.	(923)	(882)	975	961	972	954	980	938	984	4
	: S.D.	3.6	3.7	1.4	2.8	2.4	5.0	1.4	2.6	1.1	
B250	: Av.	(932)	(897)	979	966	976	961	985	945	985	4
	: S.D.	4.8	7.1	3.4	2.7	2.4	2.5	2.9	6.2	0.5	
B255	: Av.	(936)	(897)	984	969	978	962	986	953	987	4
	: S.D.	2.4	2.6	2.5	2.9	2.2	2.4	1.4	3.3	2.2	
B256	: Av.	943	(899)	983	969	977	965	986	958	984	4
	: S.D.	9.8	5.6	1.4	2.2	1.7	3.4	1.4	1.6	0.8	
B257	: Av.	(934)	(892)	976	965	973	960	984	952	986	4
	: S.D.	2.7	2.6	0.5	1.4	1.0	1.1	1.3	3.4	2.2	
B260	: Av.	942	(906)	982	972	978	966	986	959	986	3
	: S.D.	0.7	14.5	3.5	2.1	1.0	0.7	2.6	5.9	1.0	
B265	: Av.	941	(900)	982	970	978	966	987	957	988	4
	: S.D.	7.7	6.2	4.6	2.2	2.5	2.5	1.9	2.2	2.0	

Table 9 (Page 17)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas aeruginosa</u> (Cont'd.)									
B275	: Av.	945	(899)	983	971	980	964	987	951	988	4
	: S.D.	2.7	4.6	1.4	0.5	1.0	0.8	1.6	1.0	1.5	
B282	: Av.	(940)	(902)	976	964	973	962	982	945	984	4
	: S.D.	9.1	5.7	4.2	6.2	4.2	8.0	4.1	8.4	0.8	
B323	: Av.	955	(904)	988	975	986	972	991	956	993	4
	: S.D.	2.1	3.7	2.8	1.4	1.4	2.4	1.4	6.9	2.2	
B325	: Av.	943	(902)	988	974	982	969	989	955	990	4
	: S.D.	17.7	5.5	2.4	3.2	2.4	4.4	1.3	2.2	0.5	
B428	: Av.	949	(914)	984	973	978	969	986	964	988	4
	: S.D.	4.8	1.4	2.2	1.9	1.1	1.5	0.8	0.5	1.1	
B431	: Av.	(935)	(903)	978	964	974	958	983	945	984	4
	: S.D.	2.2	2.8	1.3	0.8	0.8	1.0	1.0	2.5	1.3	
B450	: Av.	942	(904)	984	969	979	966	987	956	988	4
	: S.D.	9.4	2.7	2.2	3.0	2.6	4.5	1.7	3.8	1.5	
B451	: Av.	(948)	(911)	989	972	983	969	991	955	991	4
	: S.D.	10.1	6.7	5.6	5.2	4.6	5.8	3.5	6.1	2.2	
B452	: Av.	942	(902)	988	974	982	968	990	959	990	4
	: S.D.	11.0	3.9	1.9	0.8	0.8	2.8	1.1	1.7	0.0	
B534	: Av.	942	(893)	982	968	977	964	986	951	985	4
	: S.D.	5.9	9.3	4.2	2.9	2.4	3.2	2.6	4.4	2.5	
B716	: Av.	942	(905)	988	974	982	968	989	956	990	4
	: S.D.	8.7	5.1	3.3	2.5	2.4	2.8	2.1	2.2	1.3	
B743	: Av.	950	(903)	988	977	984	973	992	964	994	4
	: S.D.	8.6	5.7	1.4	0.0	1.0	1.8	2.2	0.8	0.5	
B771	: Av.	(936)	(895)	983	969	978	962	984	958	992	4
	: S.D.	1.0	3.4	1.3	0.8	2.0	1.8	4.5	2.1	1.1	
B786	: Av.	(944)	(906)	984	970	978	963	988	954	988	4
	: S.D.	8.2	5.7	6.0	5.5	5.9	7.6	4.5	8.7	2.2	
B800	: Av.	946	(905)	984	969	978	966	987	953	985	4
	: S.D.	5.7	2.6	2.2	1.4	1.0	0.8	1.3	1.7	1.3	

Table 9 (Page 18)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas aeruginosa</u> (Cont'd.)									
B804	: Av.	961	(924)	992	982	988	972	996	960	996	3
	: S.D.	17.3	27.2	2.1	1.7	4.1	6.8	3.5	12.4	6.7	
B822	: Av.	(932)	(896)	977	963	974	956	984	942	989	4
	: S.D.	3.4	3.1	1.4	1.8	2.2	2.5	1.4	1.4	1.5	
B853	: Av.	(936)	(899)	982	968	977	965	986	954	987	4
	: S.D.	5.3	1.0	1.1	1.4	0.5	1.4	1.8	1.0	2.1	
B903	: Av.	972	(964)	996	982	982	975	993	972	987	4
	: S.D.	3.2	4.1	3.2	3.6	3.6	2.7	4.0	1.3	3.7	
B904	: Av.	(965)	(948)	988	978	979	972	988	969	987	4
	: S.D.	2.9	3.8	3.6	2.2	2.2	2.0	2.2	2.6	1.8	
B937	: Av.	952	(909)	984	972	981	968	989	956	988	4
	: S.D.	8.8	5.9	4.6	3.2	3.6	3.5	3.5	2.4	1.4	
B982	: Av.	936	(900)	982	968	976	965	986	952	986	4
	: S.D.	4.0	5.0	2.4	1.9	2.1	3.5	1.4	1.4	1.0	
B997	: Av.	950	(908)	988	977	985	970	992	951	994	4
	: S.D.	6.3	3.0	3.9	4.4	4.2	5.6	3.8	3.6	2.6	
B1000	: Av.	(928)	(888)	976	961	972	957	982	942	984	4
	: S.D.	3.2	6.4	1.0	1.8	2.2	3.0	2.2	2.9	1.7	
B1019	: Av.	938	(896)	969	957	968	957	976	936	975	4
	: S.D.	8.8	5.9	3.1	4.6	3.3	5.5	2.2	5.9	0.5	
B1069	: Av.	939	(902)	977	965	974	962	983	946	982	4
	: S.D.	7.7	4.6	2.4	2.2	1.8	2.2	1.7	5.9	3.2	
B1080	: Av.	(936)	(894)	981	966	976	960	986	946	986	4
	: S.D.	4.8	2.9	1.7	3.5	2.7	2.9	2.6	5.0	1.1	
B1083	: Av.	938	(902)	985	972	979	966	988	955	987	4
	: S.D.	8.5	2.7	2.1	2.6	2.1	2.4	2.4	2.2	2.7	
B1087	: Av.	952	(910)	986	974	982	969	990	956	989	4
	: S.D.	5.0	8.5	3.0	4.8	4.5	3.2	4.0	3.0	3.0	
B1088	: Av.	942	(906)	973	960	972	960	981	932	976	4
	: S.D.	6.3	4.5	4.3	4.4	3.8	4.2	4.1	2.5	2.1	

Table 9 (Page 19)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas aeruginosa</u> (Cont'd.)									
B1235	: Av.	(936)	(896)	979	965	974	958	983	945	985	4
	: S.D.	2.1	5.8	2.8	2.1	2.1	2.1	2.3	1.9	1.7	
B1236	: Av.	(931)	(894)	976	963	972	954	982	942	986	4
	: S.D.	1.5	5.5	2.0	2.2	1.7	1.8	1.4	2.6	1.1	
B1247	: Av.	(939)	(902)	984	972	979	966	987	955	990	5
	: S.D.	4.2	9.8	2.2	3.2	2.6	4.2	1.6	1.7	0.7	
B1360	: Av.	(936)	(904)	982	968	976	963	985	956	984	4
	: S.D.	4.9	6.8	2.8	2.4	1.9	1.5	2.2	2.4	2.9	
B1361	: Av.	942	(906)	980	967	975	964	986	953	984	4
	: S.D.	4.8	3.4	1.8	1.3	1.3	1.4	2.7	2.4	2.4	
B1362	: Av.	(938)	(900)	977	964	972	958	982	948	986	4
	: S.D.	1.4	3.2	1.5	1.8	1.8	1.4	2.0	1.4	1.4	
	:	<u>Pseudomonas allicola</u>									
B823	: Av.	(924)	(868)	978	964	973	945	983	948	988	4
	: S.D.	11.6	15.9	5.3	8.2	4.6	12.4	4.0	6.3	2.5	
B828	: Av.	954	(918)	982	970	979	964	986	960	982	4
	: S.D.	5.2	9.2	5.5	5.2	4.6	5.8	3.7	6.4	1.4	
	:	<u>Pseudomonas aminovorans</u>									
B934	: Av.	951	(917)	987	977	982	966	989	962	986	4
	: S.D.	3.6	4.9	1.6	1.6	1.3	3.0	1.8	3.2	0.5	
	:	<u>Pseudomonas angulata</u>									
B821	: Av.	948	(902)	986	975	982	969	990	961	996	4
	: S.D.	7.7	10.3	1.0	0.5	1.8	1.7	0.5	4.8	2.2	
B824	: Av.	967	(932)	1004	989	992	983	1010	982	1015	5
	: S.D.	7.4	8.5	2.8	1.2	2.7	1.9	5.1	1.2	1.7	
B825	: Av.	983	(953)	1013	994	1002	989	1013	986	1018	10
	: S.D.	4.3	10.1	2.9	6.2	7.8	4.8	2.7	5.6	1.6	
	:	<u>Pseudomonas apii</u>									
B772	: Av.	955	(908)	990	978	984	974	992	957	999	2
	: S.D.	14.1	6.4	7.8	4.2	3.6	6.4	2.2	11.3	8.5	

Table 9 (Page 20)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas atrofaciens</u>									
B773	: Av.	954	(923)	989	978	985	974	992	967	998	4
	: S.D.	1.8	3.9	0.8	0.5	0.0	0.5	0.8	3.6	2.4	
B827	: Av.	961	(914)	987	976	981	974	989	956	987	3
	: S.D.	7.4	10.8	6.4	4.4	4.1	5.5	5.5	10.0	6.8	
	:	<u>Pseudomonas barkeri</u>									
B830	: Av.	967	(909)	989	977	983	974	992	956	988	5
	: S.D.	20.6	15.9	4.4	4.7	3.9	3.1	8.0	7.0	4.9	
	:	<u>Pseudomonas boreopolis</u>									
B549	: Av.	936	(890)	970	958	970	956	978	947	978	2
	: S.D.	7.8	3.6	1.0	2.8	0.0	1.0	0.0	1.4	1.0	
B550	: Av.	(935)	(888)	977	961	970	958	983	948	987	4
	: S.D.	5.7	9.0	2.1	1.4	3.3	2.4	1.1	2.6	2.2	
	:	<u>Pseudomonas calco-acetica</u>									
B803	: Av.	(932)	(891)	978	967	972	959	980	952	986	4
	: S.D.	4.7	7.1	1.4	2.0	1.9	2.2	1.5	2.6	0.5	
B933	: Av.	980	(960)	1023	1009	1016	993	1020	994	1027	8
	: S.D.	9.7	11.9	2.3	13.2	2.4	10.2	1.5	13.6	3.1	
	:	<u>Pseudomonas caviae</u>									
B966	: Av.	(939)	(892)	984	974	979	966	986	952	998	2
	: S.D.	15.5	17.7	8.5	6.4	7.1	7.8	7.8	12.0	20.5	
B967	: Av.	954	(895)	988	979	983	971	997	962	990	3
	: S.D.	5.5	23.6	4.1	2.1	3.6	2.3	13.6	10.4	1.6	
B968	: Av.	(937)	(880)	984	971	980	963	993	953	991	3
	: S.D.	18.9	20.8	13.8	11.0	11.7	11.0	21.7	4.0	8.6	
	:	<u>Pseudomonas chloroaphis</u>									
B560	: Av.	960	(894)	986	975	983	973	991	954	988	6
	: S.D.	4.8	3.4	4.2	2.1	3.3	3.3	2.9	2.7	1.7	

Table 9 (Page 21)

Wavelength in microns		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>		<u>Pseudomonas chlororaphis</u> (Cont'd.)									
B561	Av.	961	(890)	988	976	985	974	995	953	990	8
	S.D.	8.2	8.2	6.5	4.2	4.6	3.9	7.0	5.3	2.0	
B977	Av.	959	(907)	988	973	982	971	990	945	980	4
	S.D.	6.7	9.3	3.9	1.5	1.4	2.6	3.2	2.1	4.4	
B1095	Av.	968	(905)	992	977	986	978	994	958	987	5
	S.D.	9.2	21.1	4.9	4.4	4.6	6.2	4.0	9.3	2.6	
B1541	Av.	956	(888)	985	973	982	971	990	952	986	7
	S.D.	11.1	24.5	3.6	4.9	3.7	5.5	4.2	9.0	2.7	
		<u>Pseudomonas cichorii</u>									
B832	Av.	958	(892)	987	979	986	974	994	958	993	4
	S.D.	6.2	11.1	7.0	5.3	4.1	5.9	7.6	7.3	4.7	
		<u>Pseudomonas coronafaciens</u>									
B834	Av.	995	974	1024	1006	1012	998	1017	995	1019	1
		<u>Pseudomonas cruciviae</u>									
B932	Av.	(939)	(888)	974	962	972	958	982	954	986	4
	S.D.	4.8	6.2	6.8	6.1	5.4	6.3	5.1	5.8	2.1	
B1021	Av.	955	(899)	1004	981	996	971	1008	956	998	8
	S.D.	18.6	21.6	37.8	22.0	31.4	14.4	33.4	14.6	24.4	
B1090	Av.	(924)	(874)	977	949	966	(938)	983	938	992	5
	S.D.	13.3	13.2	22.7	20.1	13.5	15.4	18.3	11.7	13.7	
		<u>Pseudomonas denitrificans</u>									
B1028	Av.	(943)	(894)	981	969	976	964	988	961	986	4
	S.D.	19.0	16.1	8.7	9.4	7.5	10.2	6.9	11.2	3.6	
		<u>Pseudomonas desmolyticum</u>									
B979	Av.	(932)	(886)	982	968	977	960	986	950	989	4
	S.D.	2.2	5.7	3.8	3.9	2.6	4.4	2.5	1.8	2.4	

Table 9 (Page 22)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas eisenbergii</u>									
B993	: Av.	973	(915)	1011	988	1001	985	1027	965	995	3
	: S.D.	5.5	4.6	10.1	4.7	12.7	6.1	14.2	9.5	6.0	
B994	: Av.	973	(915)	998	982	989	980	1000	966	991	8
	: S.D.	3.3	4.9	10.1	3.8	5.6	3.2	8.8	6.1	4.8	
B995	: Av.	945	(893)	982	970	980	969	988	936	988	4
	: S.D.	6.6	4.9	1.0	0.8	2.2	1.6	1.6	1.8	0.8	
B1023	: Av.	977	(940)	1013	991	1000	986	1011	976	1009	4
	: S.D.	3.5	7.2	4.3	2.8	5.4	3.0	5.4	2.3	5.2	
B1245	: Av.	958	(910)	978	970	980	971	987	945	986	4
	: S.D.	1.8	3.9	2.0	1.0	1.5	1.4	1.5	5.4	1.0	
	:	<u>Pseudomonas fluorescens</u>									
B10	: Av.	(931)	(893)	971	958	969	953	978	942	980	4
	: S.D.	4.6	9.2	1.3	2.0	0.8	1.9	0.8	5.5	1.1	
B11	: Av.	(969)	(924)	1002	988	997	983	1007	972	1008	5
	: S.D.	35.3	36.0	20.3	19.3	15.4	21.0	15.3	23.8	6.7	
B253	: Av.	954	(890)	987	975	986	973	994	956	998	4
	: S.D.	12.7	4.4	4.0	7.2	4.4	8.1	5.6	7.5	8.1	
B258	: Av.	942	(888)	973	963	973	960	982	946	979	4
	: S.D.	6.5	8.4	2.9	3.2	2.3	4.4	3.3	5.8	1.0	
B1244	: Av.	98.8	(938)	1013	998	1010	993	1012	989	1016	4
	: S.D.	2.9	9.9	0.5	2.6	4.1	2.5	0.5	2.4	1.0	
	:	<u>Pseudomonas fragi</u>									
B25	: Av.	(934)	(877)	975	963	975	958	984	941	986	4
	: S.D.	9.3	12.2	4.9	5.0	4.7	4.9	3.2	4.7	1.4	
	:	<u>Pseudomonas iodina</u>									
B141	: Av.	(960)	(941)	994	985	989	980	1002	980	1000	4
	: S.D.	21.4	23.1	12.5	9.7	10.5	8.1	11.8	5.1	4.7	
B1536	: Av.	(940)	(924)	988	978	983	968	994	975	1002	4
	: S.D.	7.5	15.7	4.3	3.5	2.9	8.5	3.9	3.6	1.5	

Table 9 (Page 23)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas iodina</u> (Cont'd.)									
B1537	: Av.	(939)	(918)	988	977	982	964	994	974	1004	4
	: S.D.	9.1	7.5	1.4	2.2	3.7	9.0	2.2	2.9	1.9	
B1540	: Av.	(951)	(933)	988	979	984	971	995	976	1004	4
	: S.D.	5.6	4.4	2.2	1.7	2.7	7.3	2.7	2.2	3.3	
	:	<u>Pseudomonas mildenbergii</u>									
B21	: Av.	954	(894)	976	969	976	970	985	945	981	4
	: S.D.	1.0	10.9	1.0	0.6	0.8	1.0	0.8	3.2	0.6	
B652	: Av.	944	(902)	973	964	973	961	981	941	979	7
	: S.D.	7.0	7.4	5.7	6.3	3.6	5.7	4.7	2.9	5.1	
	:	<u>Pseudomonas pavonacea</u>									
B9	: Av.	958	(906)	983	973	982	972	989	944	982	5
	: S.D.	9.2	4.4	3.3	2.2	0.8	5.9	1.4	2.8	4.2	
B259	: Av.	977	(928)	1009	989	994	986	1003	977	1004	2
	: S.D.	2.8	3.6	9.9	4.2	6.4	3.6	9.9	2.8	7.8	
	:	<u>Pseudomonas putida</u>									
B13	: Av.	953	(897)	992	976	985	970	1000	951	991	6
	: S.D.	14.6	14.7	20.3	9.1	10.8	8.5	17.5	10.1	7.0	
B805	: Av.	(948)	(883)	985	971	982	967	991	949	990	8
	: S.D.	18.9	14.5	19.3	14.4	16.7	14.1	16.4	16.3	13.3	
	:	<u>Pseudomonas reptilivora</u>									
B6bs	: Av.	941	(874)	972	962	973	960	981	940	979	4
	: S.D.	7.4	2.8	3.0	2.6	1.4	4.2	1.7	4.7	1.0	
B66	: Av.	942	(885)	972	961	972	961	979	937	976	4
	: S.D.	1.4	4.4	1.4	1.7	0.8	1.0	0.8	1.4	1.0	
B285	: Av.	939	(882)	971	962	972	960	979	936	979	4
	: S.D.	3.0	6.4	1.0	1.4	0.6	3.0	0.6	3.0	1.4	
B334	: Av.	943	(892)	971	960	971	962	980	942	977	4
	: S.D.	6.5	11.9	6.2	9.0	4.9	6.5	5.5	13.7	3.3	

Table 9 (Page 24)

Wavelength in microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Pseudomonas reptilivora</u> (Cont'd.)									
B963	: Av.	(924)	(870)	979	964	974	955	986	946	985	4
	: S.D.	7.5	5.5	6.3	6.6	5.5	6.8	5.4	8.1	1.7	
B964	: Av.	(927)	(875)	980	966	977	958	986	949	987	4
	: S.D.	5.9	8.1	4.5	3.6	3.8	3.6	2.8	6.6	3.1	
B965	: Av.	964	(924)	1007	990	994	984	1007	978	998	4
	: S.D.	24.6	27.6	8.9	5.4	5.3	4.6	5.7	8.8	1.4	
	:	<u>Pseudomonas stutzeri</u>									
B775	: Av.	(953)	(902)	999	977	984	971	999	965	994	7
	: S.D.	17.1	15.7	19.1	10.3	11.3	10.5	15.9	8.9	7.6	
B927	: Av.	978	946	1017	995	1006	988	1016	979	1016	10
	: S.D.	6.1	23.6	7.0	9.6	7.8	4.4	5.0	4.5	4.7	
B1352	: Av.	944	(906)	974	960	970	955	979	948	977	4
	: S.D.	7.5	4.8	1.0	1.0	2.0	1.7	1.7	2.0	1.0	
	:	<u>Pseudomonas species</u>									
B1093	: Av.	960	(918)	992	980	986	977	993	963	985	4
	: S.D.	5.0	11.3	6.9	5.3	4.0	4.2	2.8	11.4	6.2	
B1094	: Av.	960	(910)	998	982	990	978	997	962	992	4
	: S.D.	6.2	7.1	3.2	3.0	2.4	2.6	1.7	6.1	2.0	
B1097	: Av.	941	(891)	982	971	981	965	988	952	992	4
	: S.D.	6.6	4.2	2.4	3.3	2.4	2.8	1.7	2.6	2.0	
B1098	: Av.	951	(904)	983	972	982	968	988	954	990	4
	: S.D.	3.5	9.5	2.2	1.7	2.2	2.2	2.6	2.0	1.7	
B1423	: Av.	965	(943)	994	984	987	976	993	971	989	4
	: S.D.	3.0	1.4	2.8	2.4	2.2	1.7	2.4	3.7	3.1	
B1457	: Av.	953	(915)	988	978	985	977	993	955	995	3
	: S.D.	2.0	8.6	4.9	5.3	3.1	4.4	3.1	6.2	6.2	
	:	<u>Sarcina flava</u>									
B1262	: Av.	(963)	(952)	1013	995	998	980	1010	1006	1022	6
	: S.D.	3.2	5.5	2.6	4.3	5.0	0.9	2.2	1.4	2.2	

Table 9 (Page 25)

Wavelength in microns		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>		<u>Sarcina lutea</u>									
B1018	Av.	(962)	(955)	1015	995	1008	979	1013	1008	1028	9
	S.D.	2.8	4.7	2.0	6.6	2.2	1.0	2.2	2.4	3.3	
		<u>Sarcina ureae</u>									
B286	Av.	(926)	(905)	963	(943)	945	(946)	971	948	986	4
	S.D.	10.8	17.1	2.0	18.9	1.0	7.3	1.4	2.7	2.2	
		<u>Serratia marcescens</u>									
B284	Av.	(925)	(877)	971	958	967	949	979	939	987	13
	S.D.	12.3	14.3	14.2	14.1	12.4	12.1	7.7	8.4	6.6	
B1481	Av.	(938)	(879)	981	966	974	958	984	950	993	5
	S.D.	5.2	7.3	4.9	3.0	4.2	5.3	3.7	4.7	2.4	
		<u>Spirillum serpens</u>									
B331	Av.	(935)	(914)	985	975	980	960	988	961	1001	6
	S.D.	6.2	11.6	6.3	5.2	3.7	5.7	5.9	5.1	8.9	
		<u>Streptomyces alni</u>									
B1521	Av.	(931)	(864)	985	970	983	959	991	968	1001	3
	S.D.	14.2	11.1	8.9	7.0	8.7	9.2	5.8	5.2	2.8	
		<u>Streptomyces bikiniensis</u>									
B1049	Av.	(953)	(923)	999	980	984	974	1005	989	1028	3
	S.D.	4.6	8.6	9.6	3.2	2.7	3.2	9.2	2.7	0.7	
		<u>Streptomyces griseus</u>									
B1078	Av.	953	(950)	1007	993	996	987	1010	996	1023	3
	S.D.	9.5	7.6	5.7	3.7	4.1	2.8	4.0	2.6	6.1	
		<u>Vibrio cyclosites</u>									
B1022	Av.	(925)	(879)	980	962	973	948	981	949	989	4
	S.D.	2.2	16.3	4.2	4.2	2.4	4.6	3.2	5.5	4.7	
		<u>Vibrio neocistes</u>									
B1037	Av.	(929)	(899)	983	973	978	953	987	957	1000	5
	S.D.	5.3	9.4	1.0	0.5	1.4	2.0	1.0	2.2	1.4	

Table 9 (Page 26)

Wavelength in microns		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>		<u>Vibrio percolans</u>									
B1055	Av.	(939)	(906)	972	958	970	956	980	939	984	6
	S.D.	3.0	17.5	3.0	2.0	3.2	0.6	2.2	4.1	1.4	
		<u>Vibrio phosphorescens</u>									
B144	Av.	(917)	(863)	976	963	973	936	982	949	997	6
	S.D.	10.7	22.2	4.1	4.1	3.7	4.7	3.6	5.4	7.5	
		<u>Vibrio tyroginus</u>									
B242	Av.	(932)	(888)	977	959	970	957	983	938	987	6
	S.D.	4.1	15.2	3.2	2.2	3.2	8.9	3.0	1.4	2.2	
		<u>Xanthomonas begoniae</u>									
B34	Av.	(958)	(957)	1005	987	988	978	999	987	1024	6
	S.D.	8.6	6.5	7.2	1.4	1.7	2.2	3.9	1.0	2.8	
		<u>Xanthomonas beticola</u>									
B1092	Av.	951	(927)	992	984	987	974	995	970	1012	6
	S.D.	4.1	10.3	1.4	2.8	1.7	2.4	1.7	4.6	4.1	
		<u>Xanthomonas campestris</u>									
B1459	Av.	980	972	1009	989	990	982	1003	988	1015	10
	S.D.	4.1	7.7	5.0	2.8	2.2	3.0	5.5	3.2	2.2	
		<u>Xanthomonas carotae</u>									
B1008	Av.	(945)	(933)	996	976	979	967	996	941	1002	6
	S.D.	8.4	8.6	12.0	3.7	2.6	3.6	11.1	13.0	2.6	
		<u>Xanthomonas geranii</u>									
B1011	Av.	984	966	1011	991	993	986	1004	990	1010	6
	S.D.	0.6	4.0	4.5	1.0	1.0	1.0	3.5	0.6	3.3	
		<u>Xanthomonas incanae</u>									
B1012	Av.	982	968	1009	992	993	985	1006	989	1018	6
	S.D.	3.9	4.5	8.4	2.4	3.2	3.0	8.7	1.0	1.0	

Table 9 (Page 27)

Wavelength in Microns	:	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5	No. of curves
<u>Strain</u>	:	<u>Xanthomonas juglandis</u>									
B1013	: Av.	982	973	1004	990	991	983	1002	990	1009	6
	: S.D.	3.5	4.8	9.5	2.0	2.2	3.7	8.4	2.4	6.2	
	:	<u>Xanthomonas malvacearum</u>									
B215	: Av.	953	(933)	994	984	989	974	1000	975	1014	6
	: S.D.	4.9	35.0	2.6	2.8	3.9	2.8	3.7	6.5	1.7	
	:	<u>Xanthomonas phaseoli</u>									
B1460	: Av.	(948)	(925)	984	972	978	965	988	967	994	7
	: S.D.	25.8	30.5	16.1	14.8	10.8	15.9	11.2	17.9	9.1	
	:	<u>Xanthomonas proteamaculans</u>									
B987	: Av.	(930)	(865)	984	969	979	958	988	956	995	2
	: S.D.	2.2	18.4	1.4	0.0	1.4	1.0	0.0	1.0	1.4	
	:	<u>Xanthomonas pruni</u>									
B1014	: Av.	(947)	(921)	1017	980	984	970	1015	957	1027	5
	: S.D.	5.0	2.7	4.2	3.6	5.2	2.6	4.4	4.7	6.8	

Year		Sample size		Number of cases		Number of deaths	
1998		1000		100		10	
1999		1000		100		10	
2000		1000		100		10	
2001		1000		100		10	
2002		1000		100		10	
2003		1000		100		10	
2004		1000		100		10	
2005		1000		100		10	
2006		1000		100		10	
2007		1000		100		10	
2008		1000		100		10	
2009		1000		100		10	
2010		1000		100		10	
2011		1000		100		10	
2012		1000		100		10	
2013		1000		100		10	
2014		1000		100		10	
2015		1000		100		10	
2016		1000		100		10	
2017		1000		100		10	
2018		1000		100		10	
2019		1000		100		10	
2020		1000		100		10	

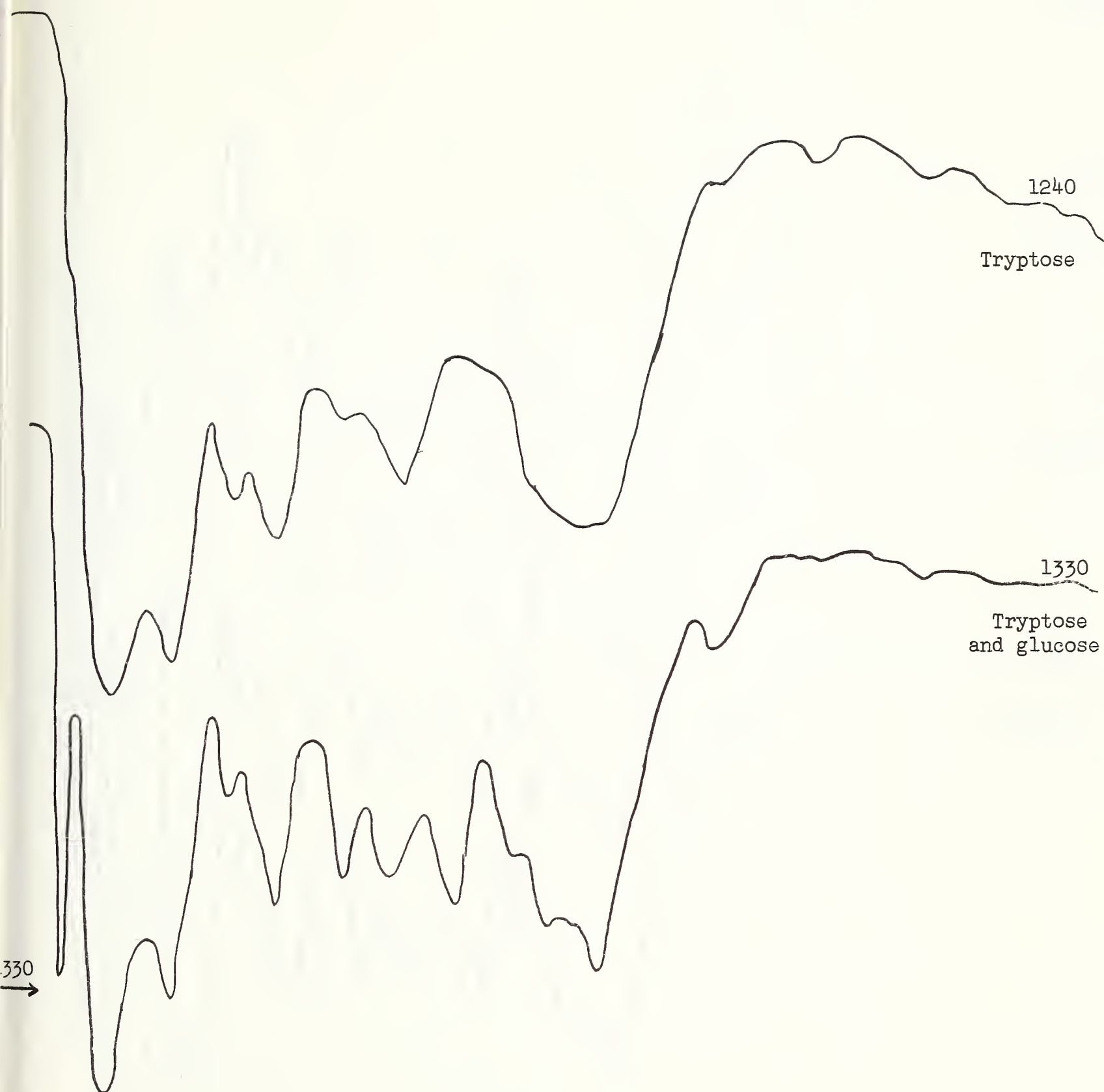


Figure 1. Effect upon the Spectrum of an "E"-type Strain of Growth in the Presence or Absence of Glucose

6 7 8 9 10 11 12

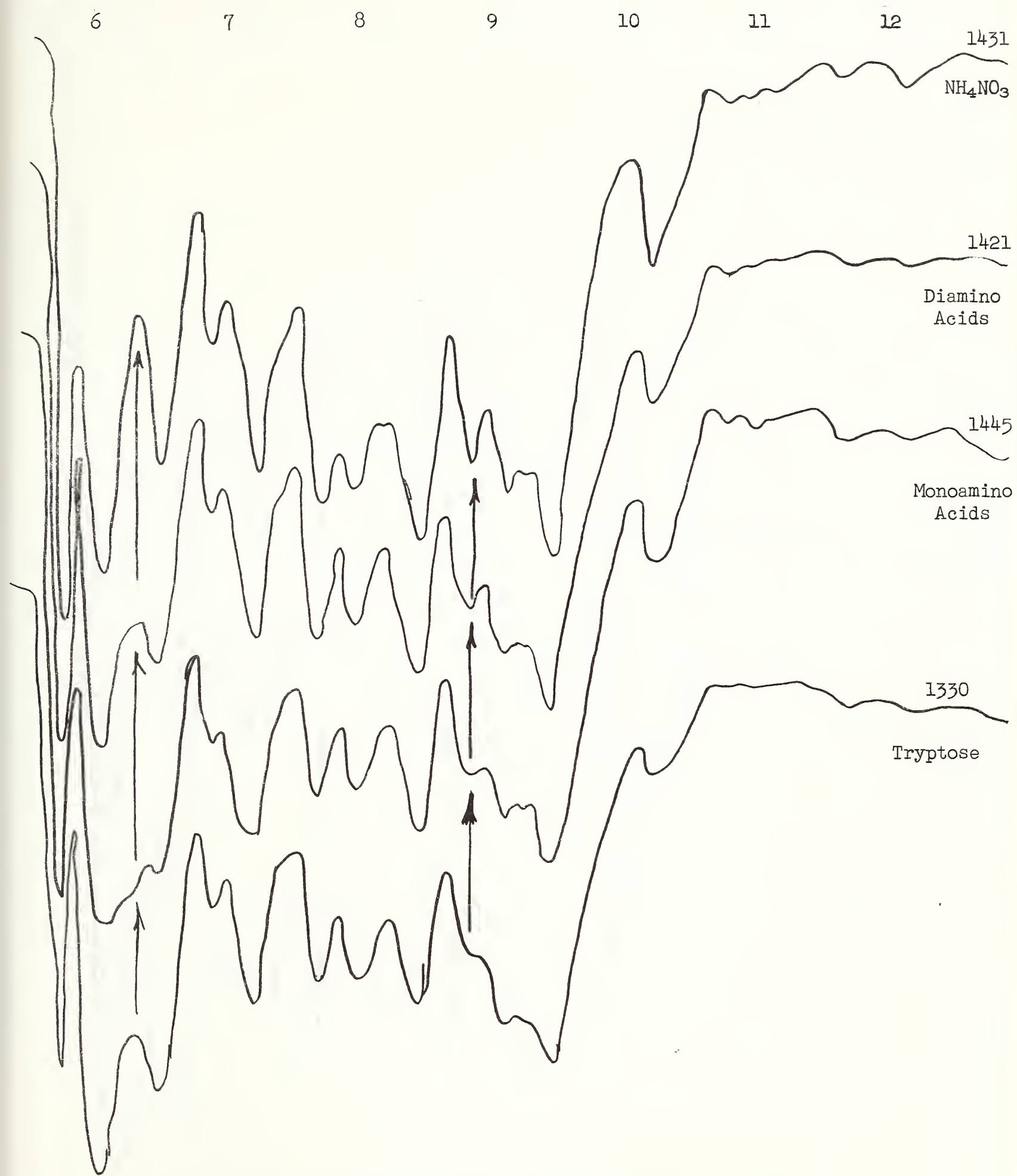


Figure 2. Effect of the Complexity of the Nitrogen Source on the Spectrum of an "E"-type Strain

6 7 8 9 10 11 12
| | | | | | |

6 7 8 9 10 11 12

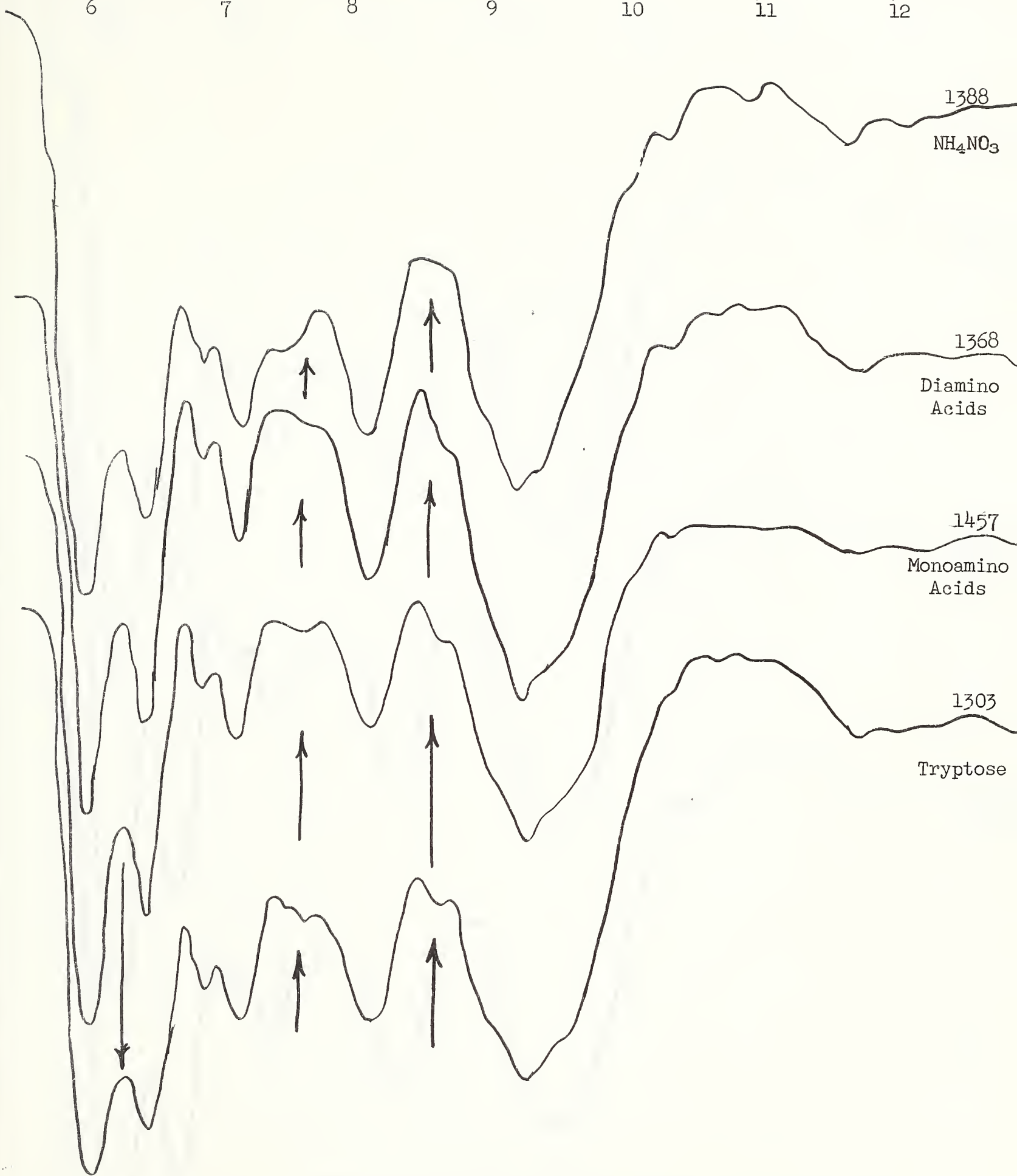


Figure 3. Effect of the Complexity of the Nitrogen Source on the Spectrum of a Non-"E"-type Strain

6 7 8 9 10 11 12

6

7

8

9

10

11

12

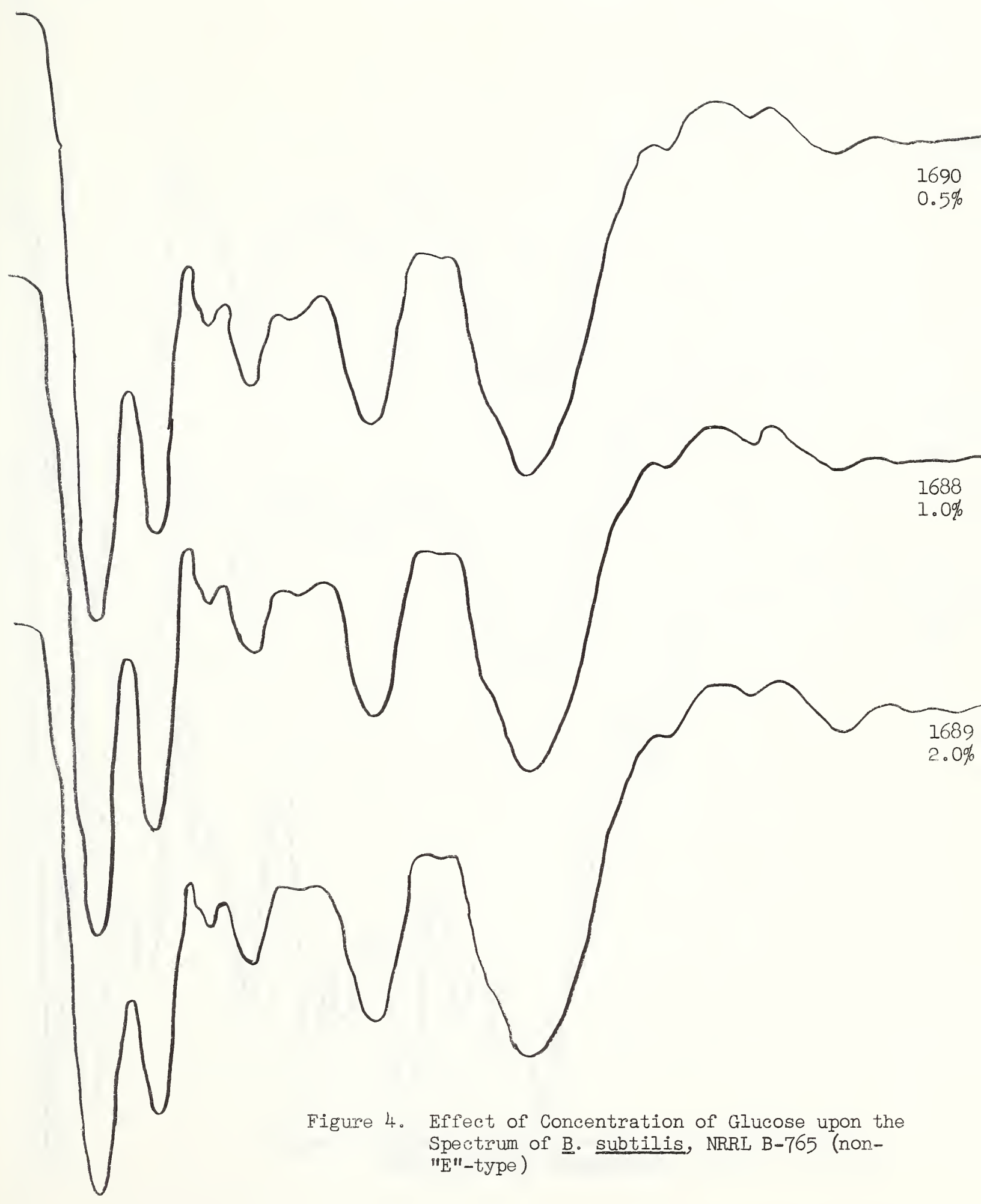


Figure 4. Effect of Concentration of Glucose upon the Spectrum of B. subtilis, NRRL B-765 (non-"E"-type)

6

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11

12

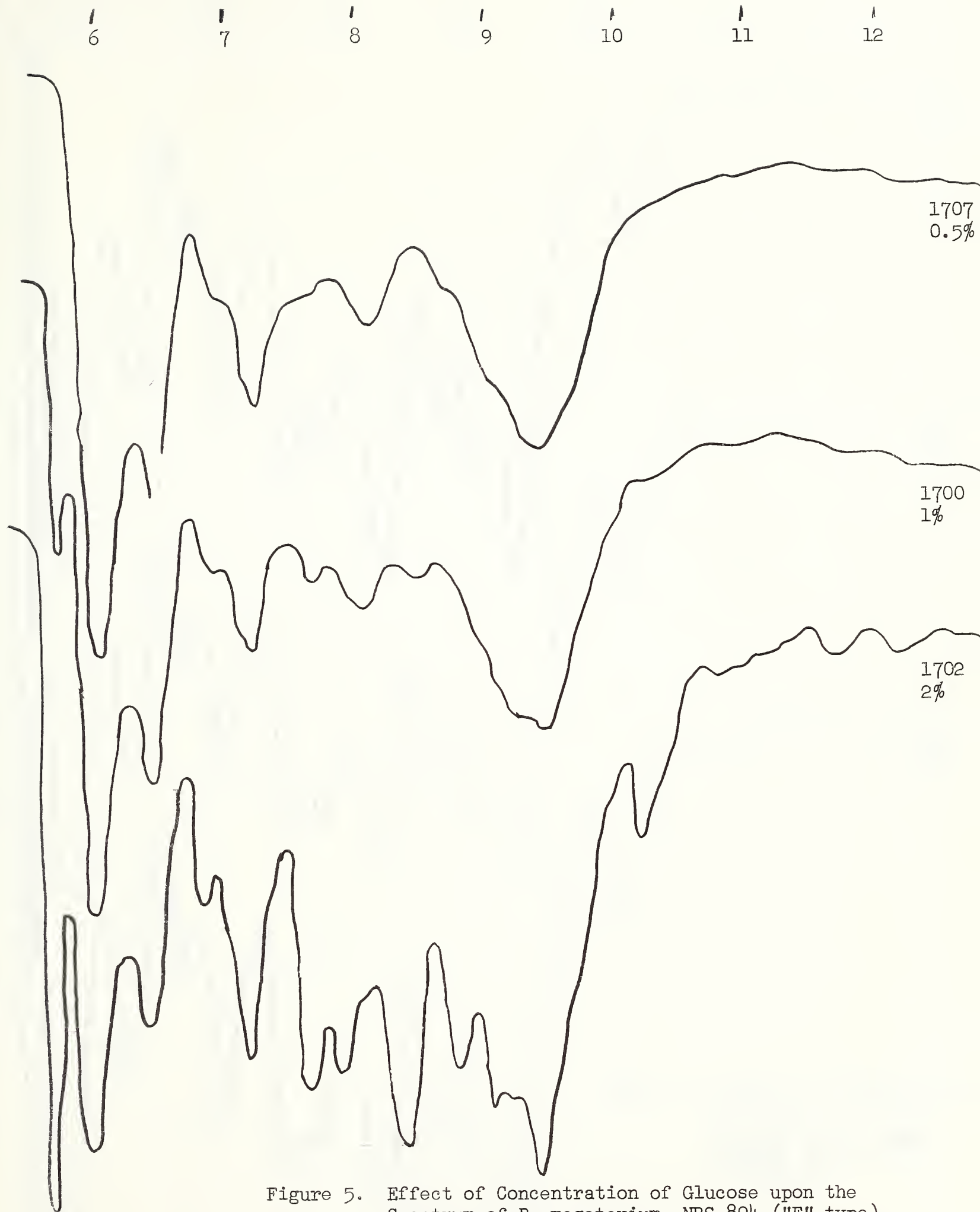


Figure 5. Effect of Concentration of Glucose upon the Spectrum of B. megaterium, NRS-894 ("E"-type).

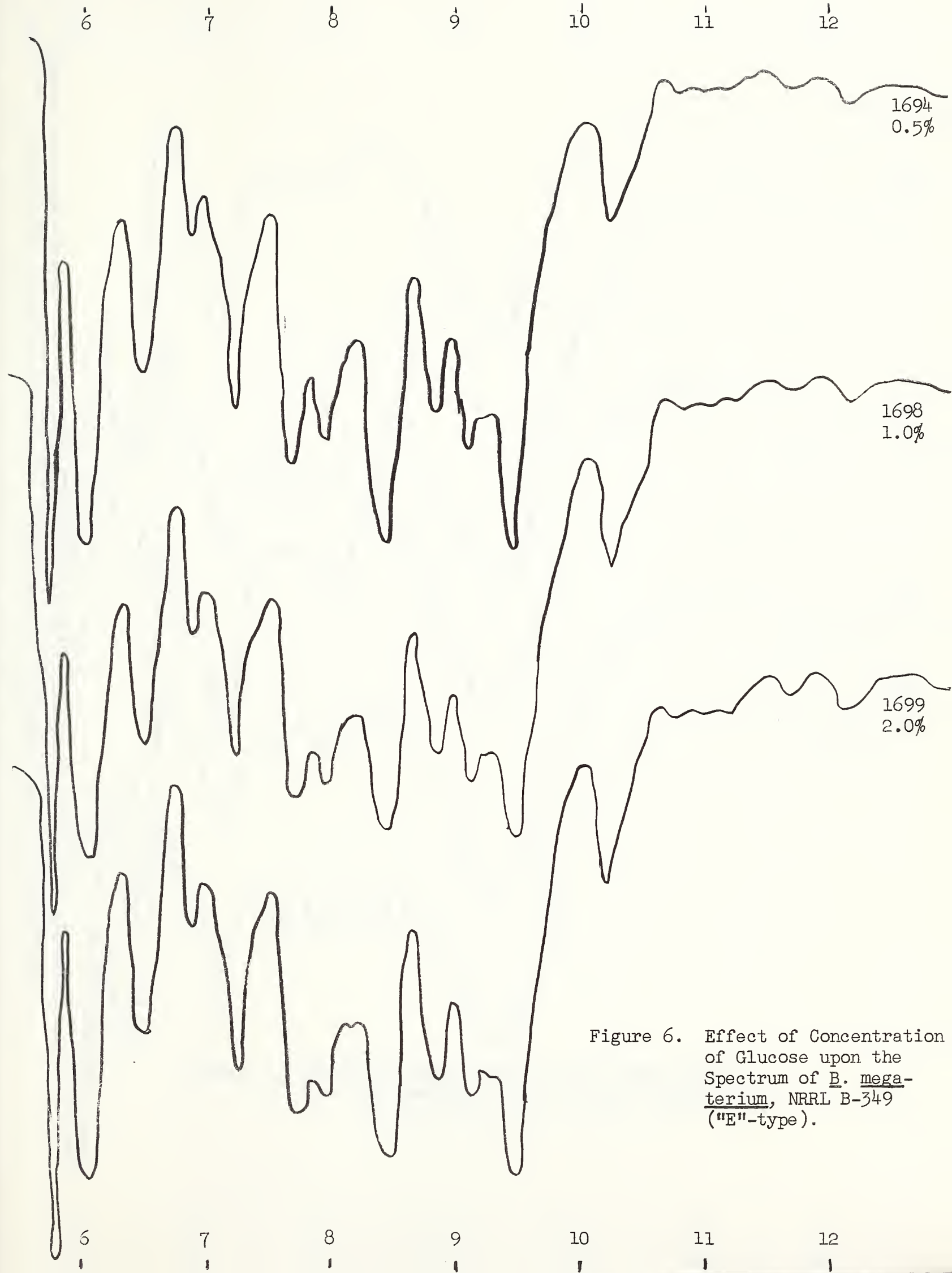


Figure 6. Effect of Concentration of Glucose upon the Spectrum of *B. megaterium*, NRRL B-349 ("E"-type).



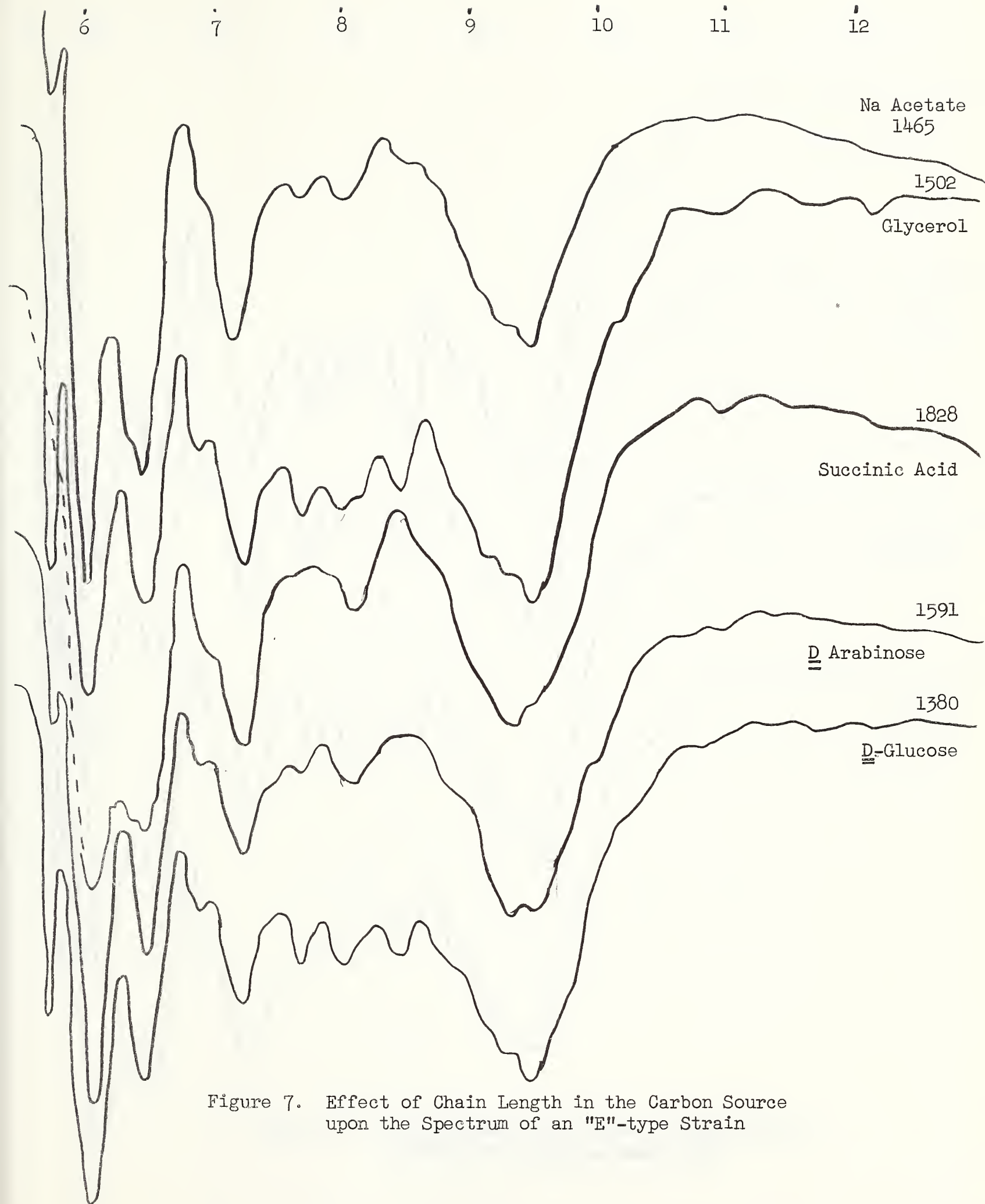


Figure 7. Effect of Chain Length in the Carbon Source upon the Spectrum of an "E"-type Strain

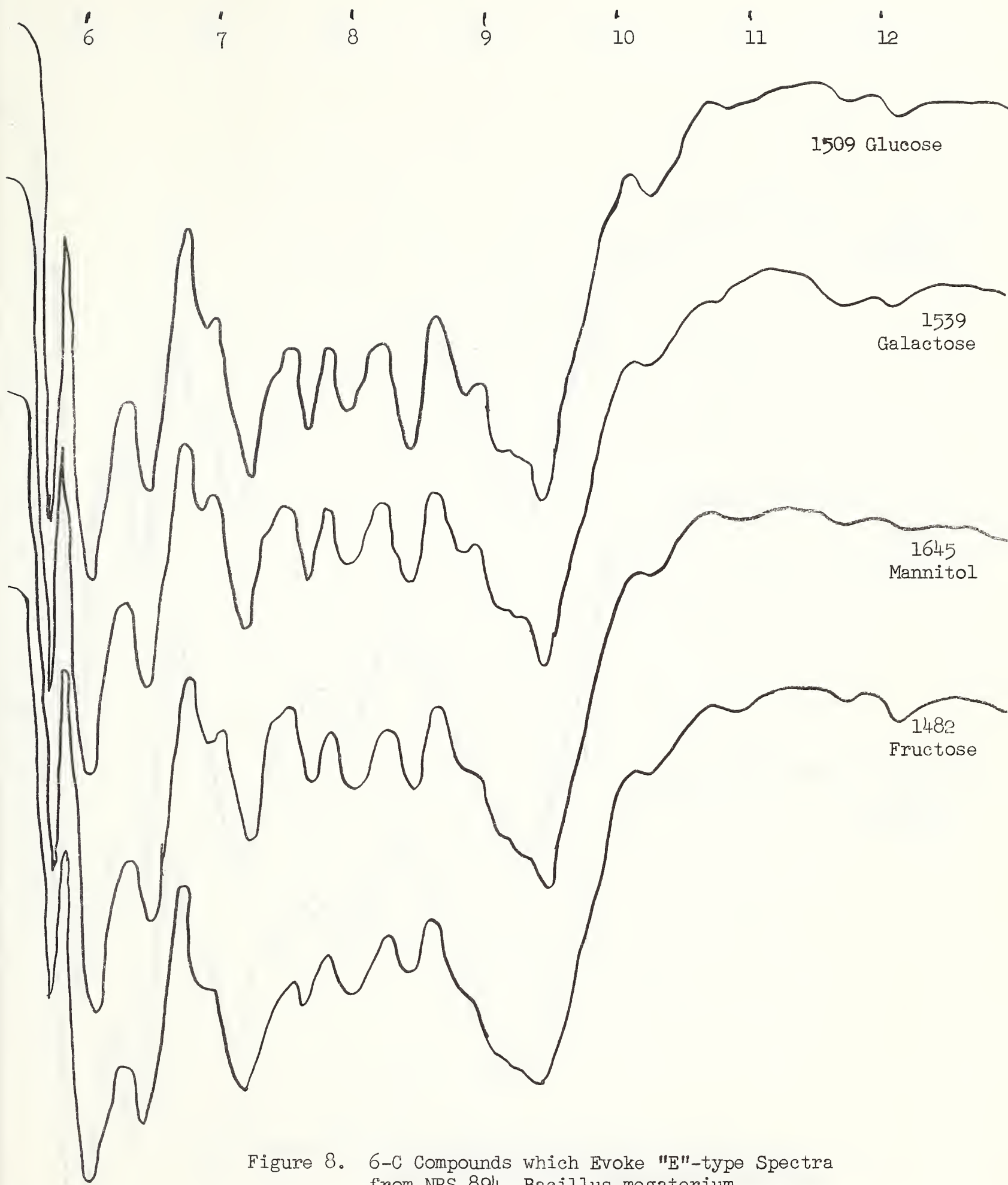


Figure 8. 6-C Compounds which Evoke "E"-type Spectra from NRS-894, Bacillus megaterium

6 7 8 9 10 11 12

6 7 8 9 10 11 12

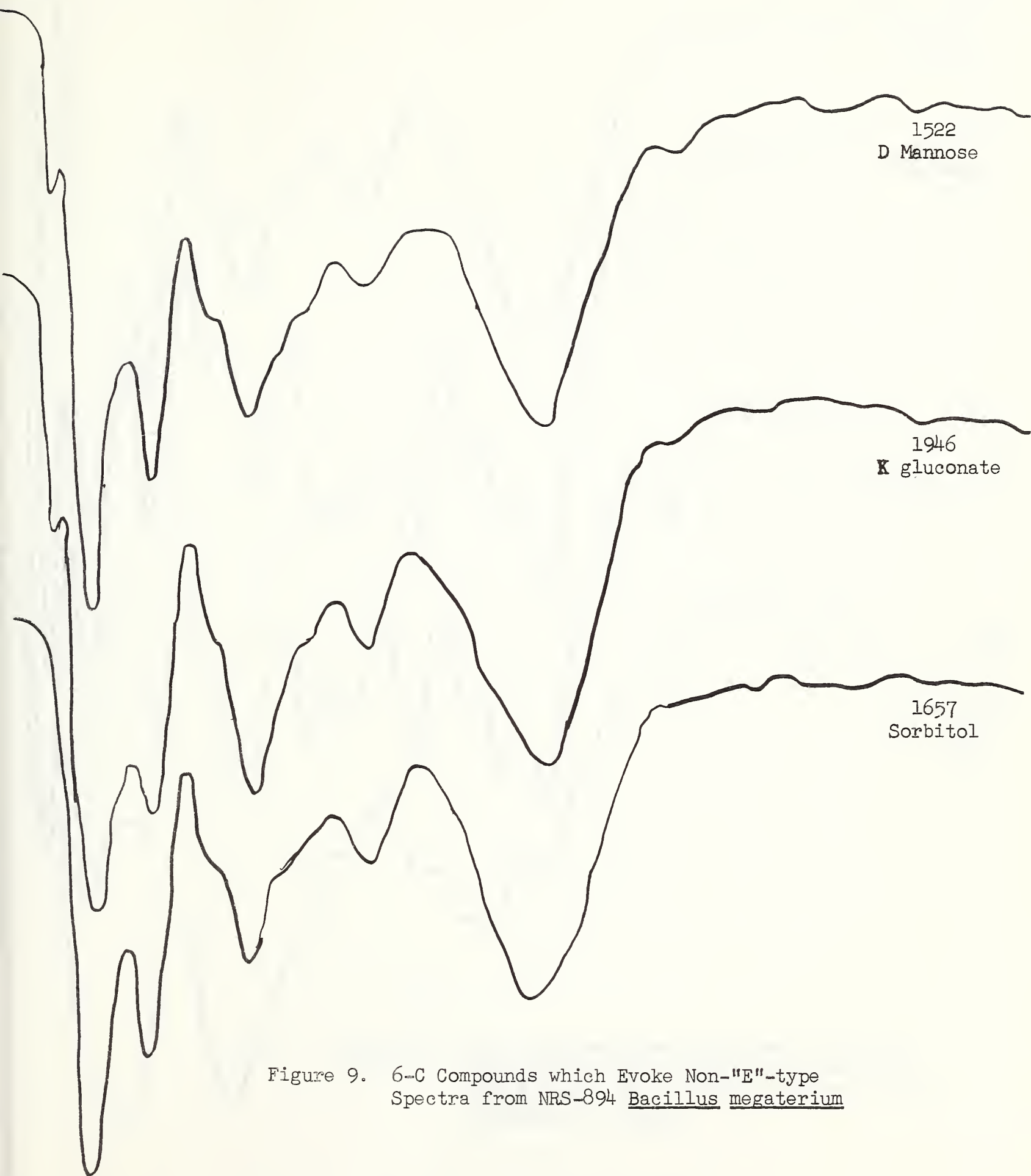
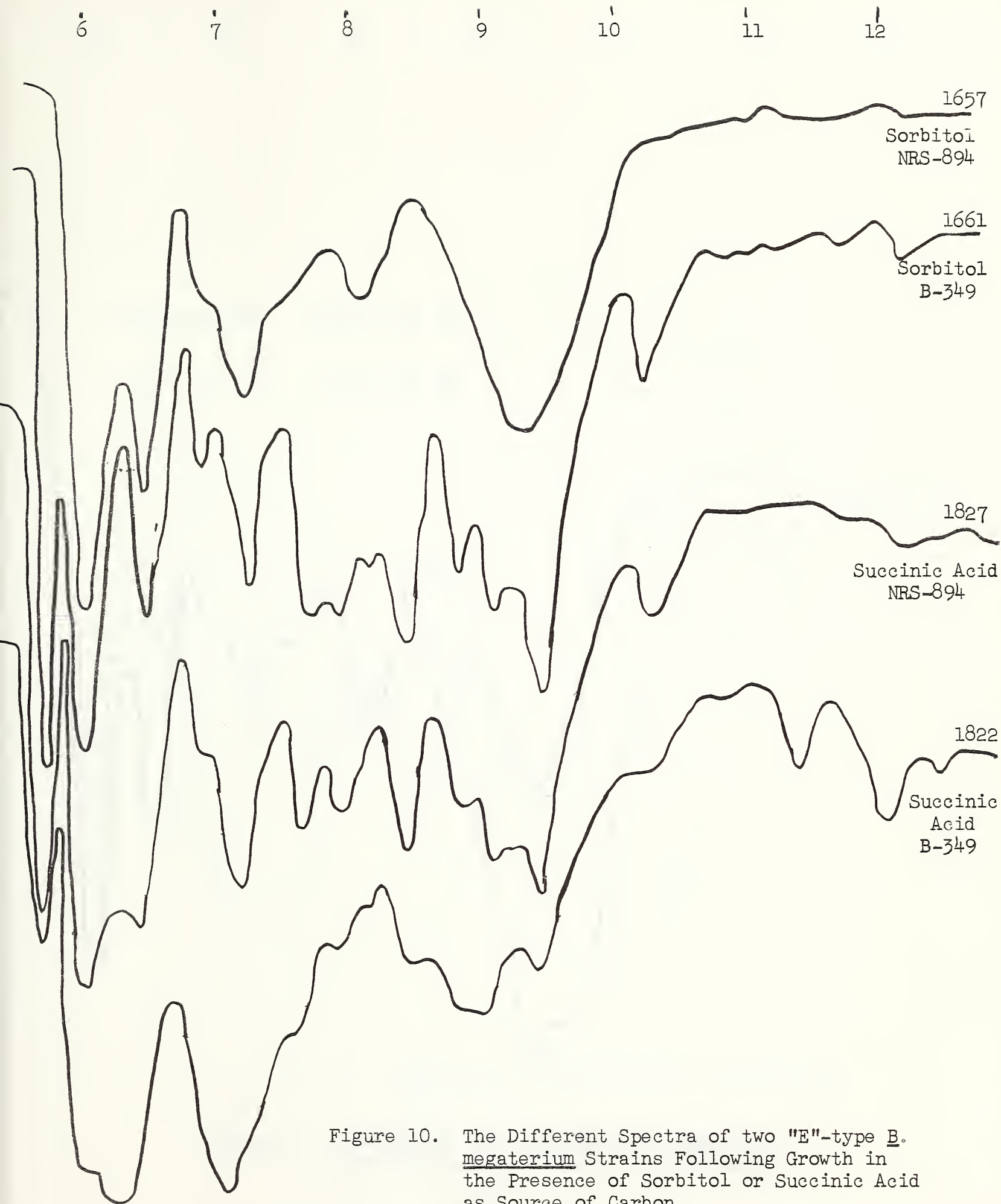


Figure 9. 6-C Compounds which Evoke Non-"E"-type Spectra from NRS-894 Bacillus megaterium

6 7 8 9 10 11 12





6 7 8 9 10 11 12

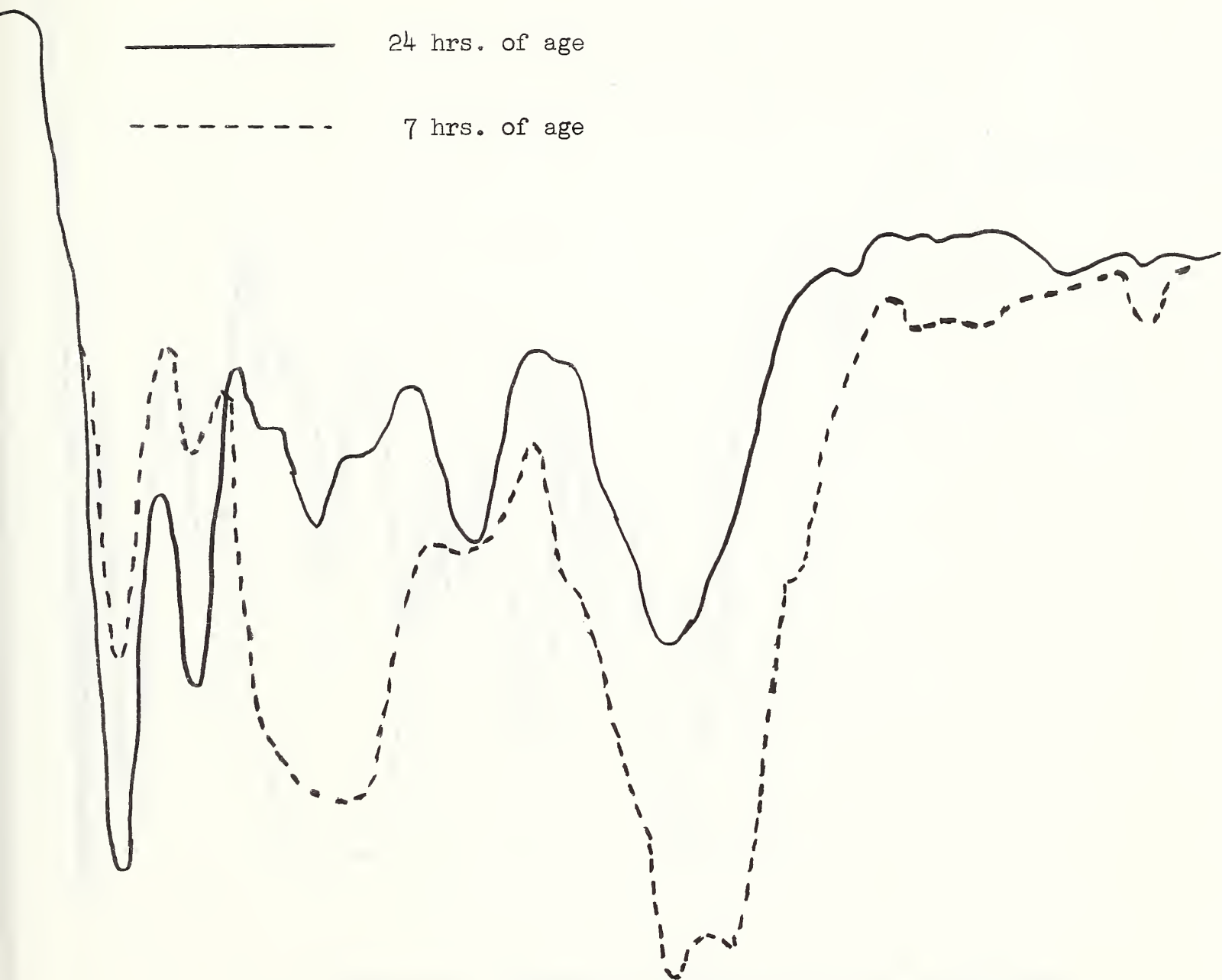


Figure 11. Changes in the Spectrum of B. subtilis, NRRL B-971, Associated with "Growing-up"

6 7 8 9 10 11 12

6

7

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9

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11

12

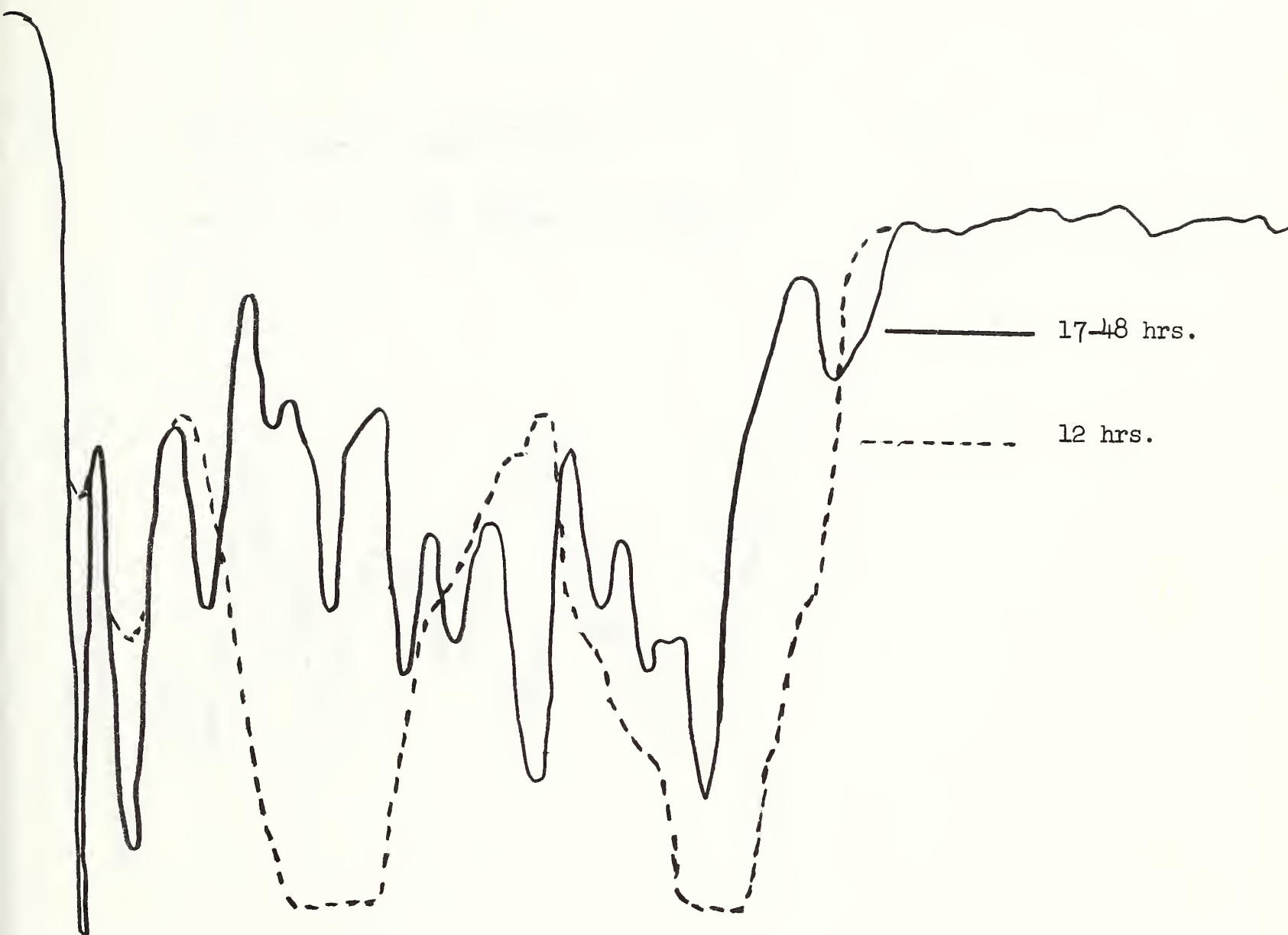


Figure 12. Changes in the Spectrum of B. megaterium, NRRL B-349, Associated with "Growing-up"

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12



6

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10

11

12

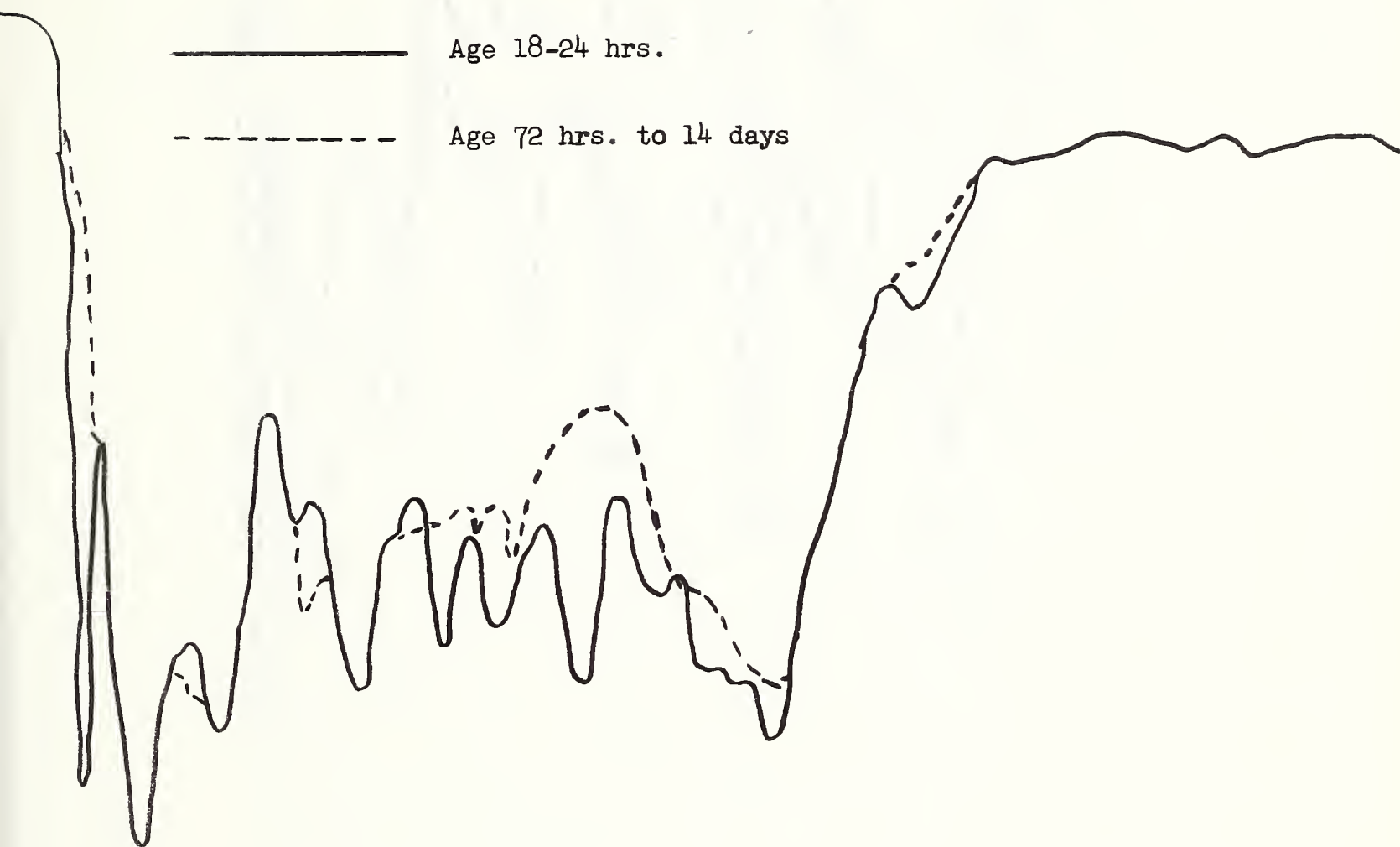


Figure 13. Changes in the Spectrum of NRS-894, B. megaterium, Associated with Ages Beyond 18-24 hours

6

7

8

9

10

11

12

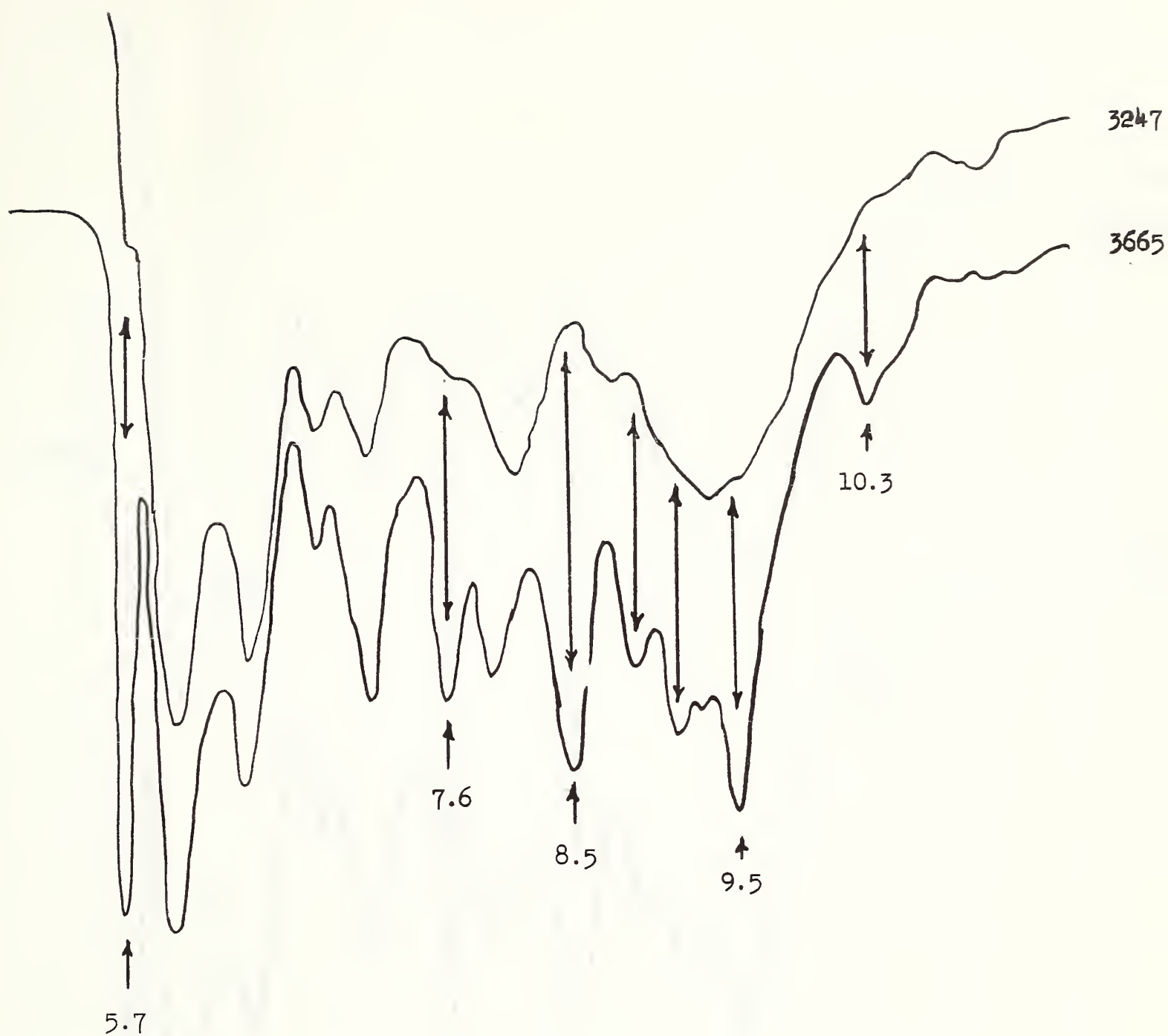


Figure 14. Extremes of Intensity of 5.7 Micron Band. Absorption weaker than that in upper curve was not considered to be a 5.7-micron band.

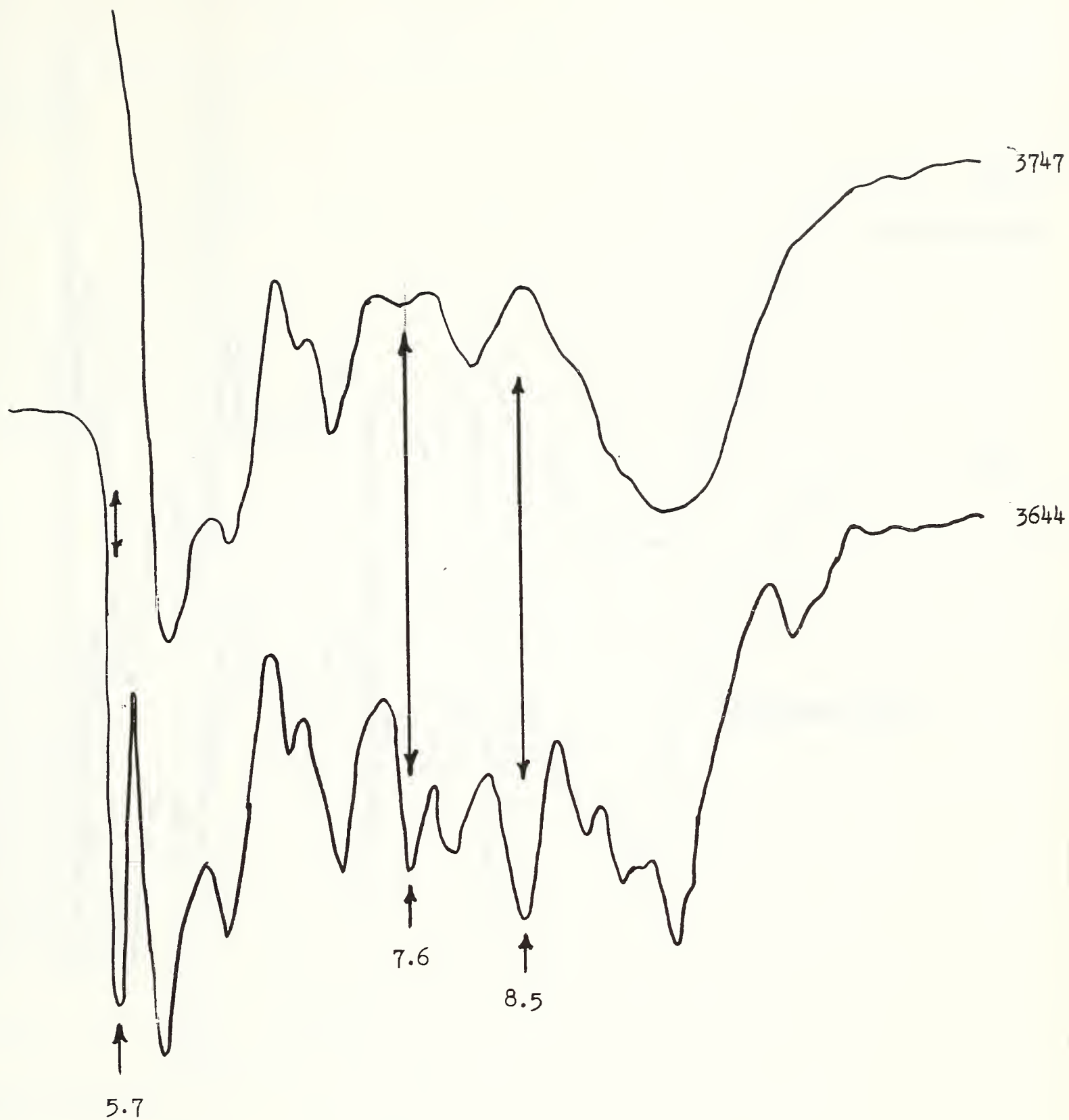


Figure 15. Extremes of Intensities in 5.7 Micron Bands in Strains of Bacillus megaterium

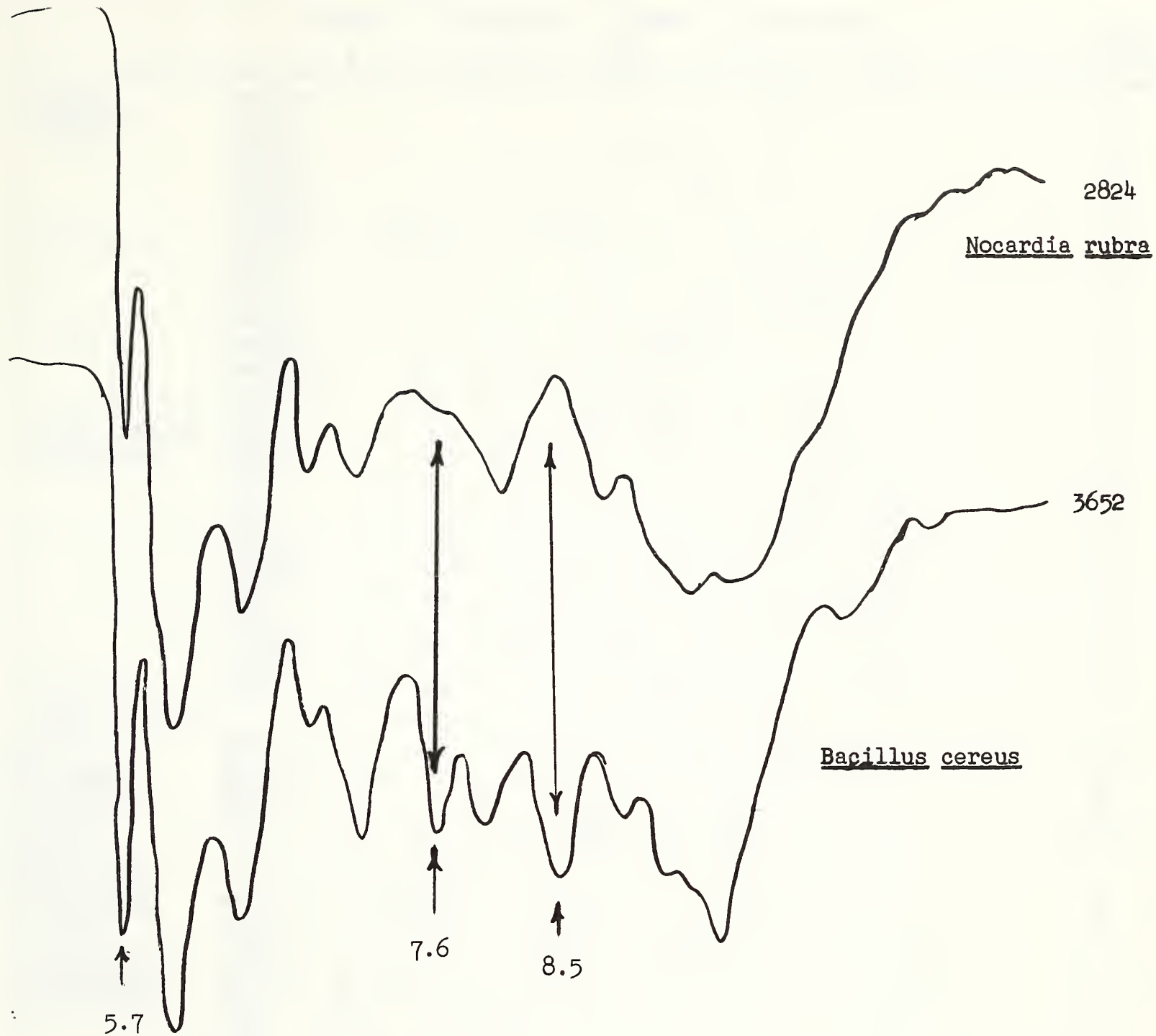
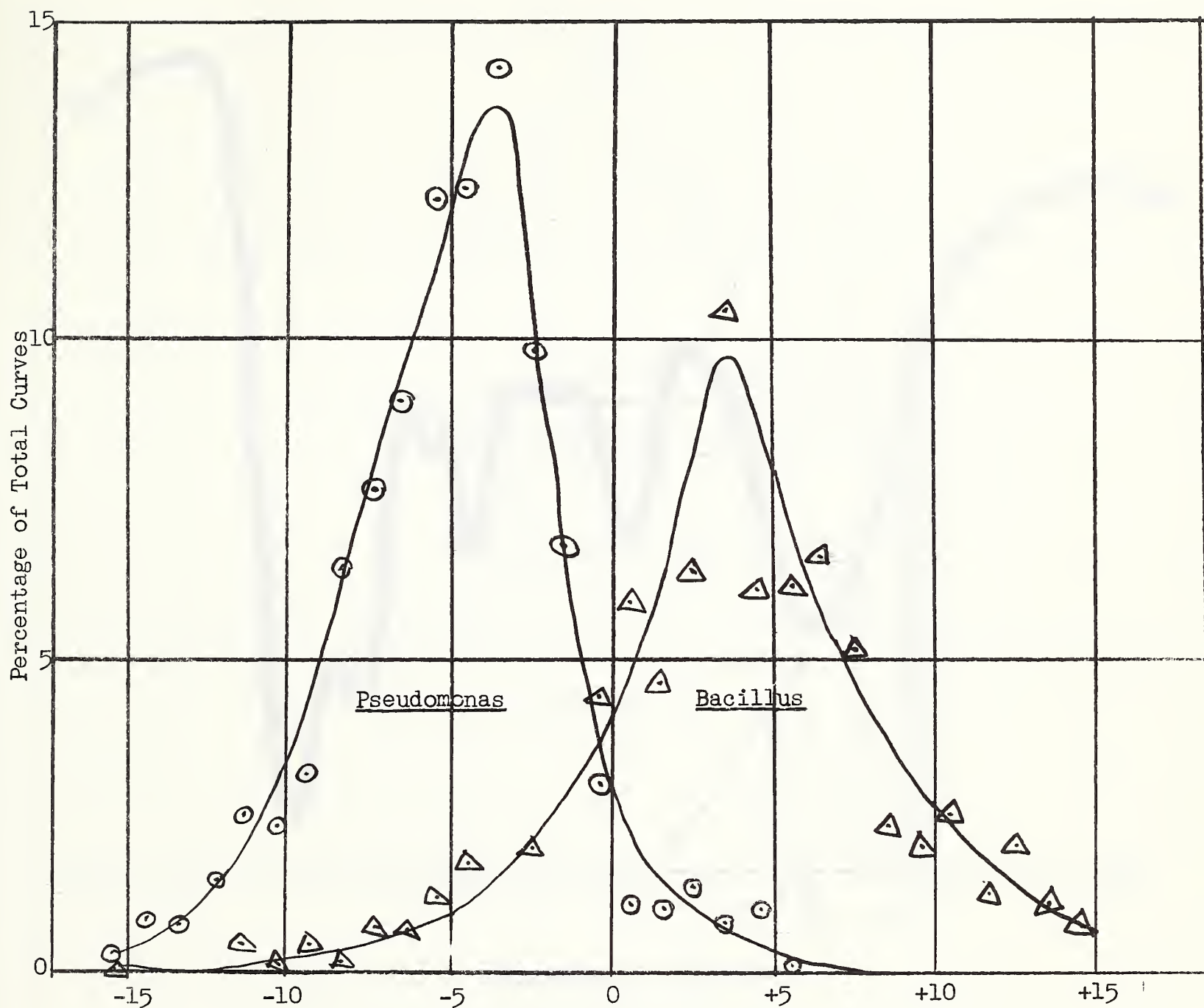


Figure 16. Infrared Curves of Nocardia rubra and Bacillus cereus

		(Trans. 5.8 Microns) - (Trans. 5.7 Microns)					Number of curves	
		0	10	20	30	40	50	
<u>Bacillus</u>	NRS305				2 1	1		4
<u>cereus</u>	B344			1	1	11		4
	NRS645			34	1			8
	NRS721				2 1	1		4
	NRS808			13				4
var <u>m.</u>	NRS306	111						3
	B346				1 1 1	1		4
	B347				1	111		4
	NRS912				11	1	1	4
var <u>t.</u>	NRS996				1111			4
	NRS1124		1	3				4
	NRS1328				11	2		4
<u>licheniformis</u>	B571			11	11			4
<u>megaterium</u>	NRS245		2	2				4
	B349					12	1	4
	B352						111	4
	B353				2	11		4
	NRS893	2		1				3
	NRS894					2 1 1		4
	B938					1	11 1	4
	NRS951		1	1 2				4
	NRS952				11	1	1	4
<u>subtilis-</u>	B972				111			3
<u>lich.intermed.</u>								
species	B1246				1	1	1	4
<u>Mycoplana</u>	B1031		1	1				2
<u>dimorpha</u>	B1091	1		1				2
<u>Nocardia</u>	B685		1	2323	2	1 11		16
<u>rubra</u>								
<u>Pseudomonas</u>								
<u>boreopolis</u>	B549		11					2
<u>cepacia</u>	B1101	11	1 1					4
<u>desmolyticum</u>	B980			1 1	11 1 1		1	7
<u>eisenbergii</u>	B1023	2	11					4
<u>reptilivora</u>	B963		211					4
	B964	4						4
	B965		2 2					4
<u>suis</u>	B1352	1	21					4
species	B1093	11		2				4
	B1094		11	2				4
<u>Rhodospirillum</u>								
<u>rubrum</u>	B175		11 11 1					5
	B279		2	1 1				4
<u>Spirillum</u>								
<u>virginianum</u>	B329				11	2 1		5
<u>Vibrio</u>								
<u>rubicundus</u>	B782				1			1

Figure 17. Magnitude of 5.7 Micron Band



(Transmission at 8.1 microns) - (Transmission at 7.2 microns)

Figure 18. Percentage Distribution of Curves by Genus According to Differences in Transmission at 8.1 and 7.2 Microns

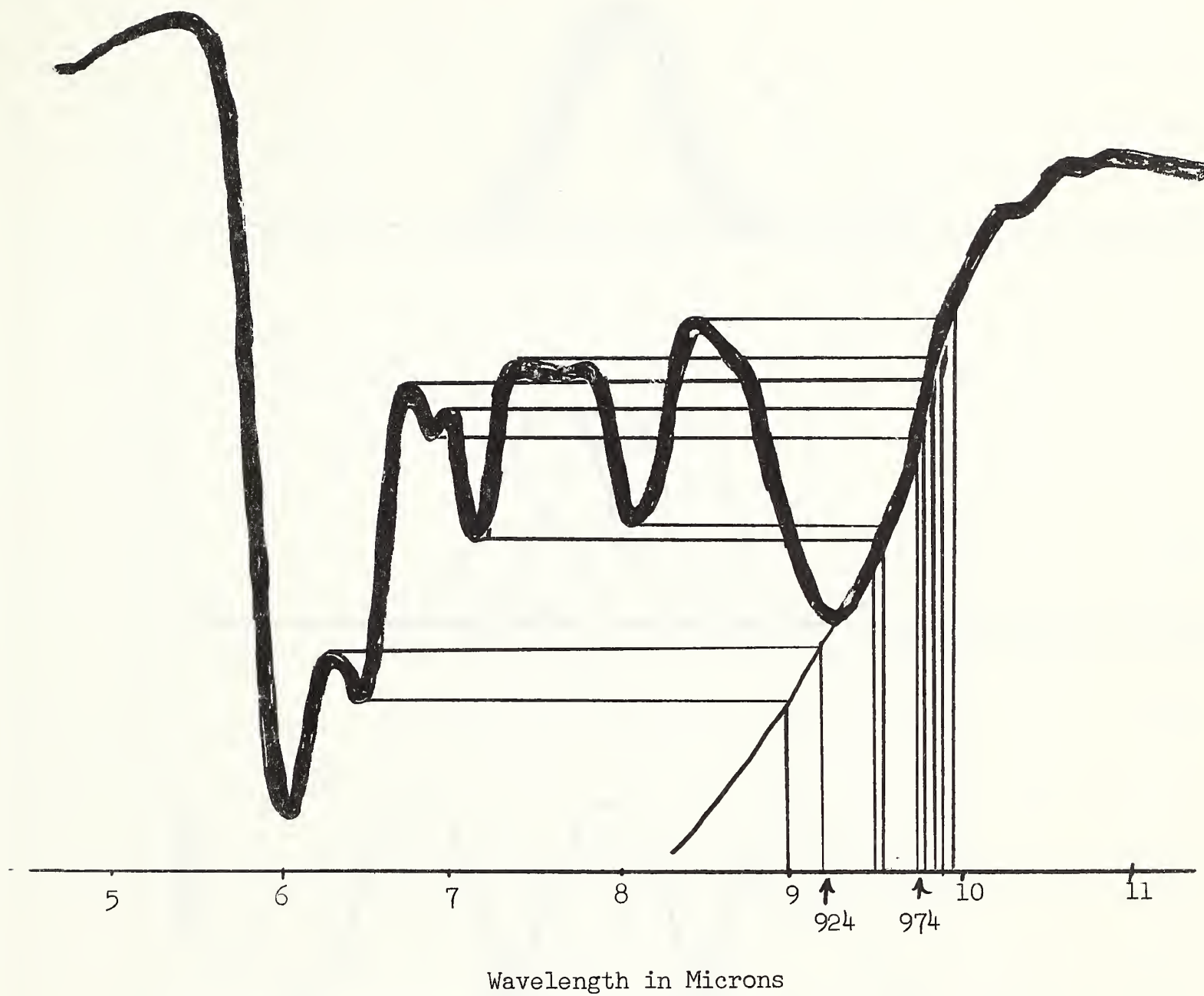


Figure 19. Method of Obtaining Transmission in Wavelength Values

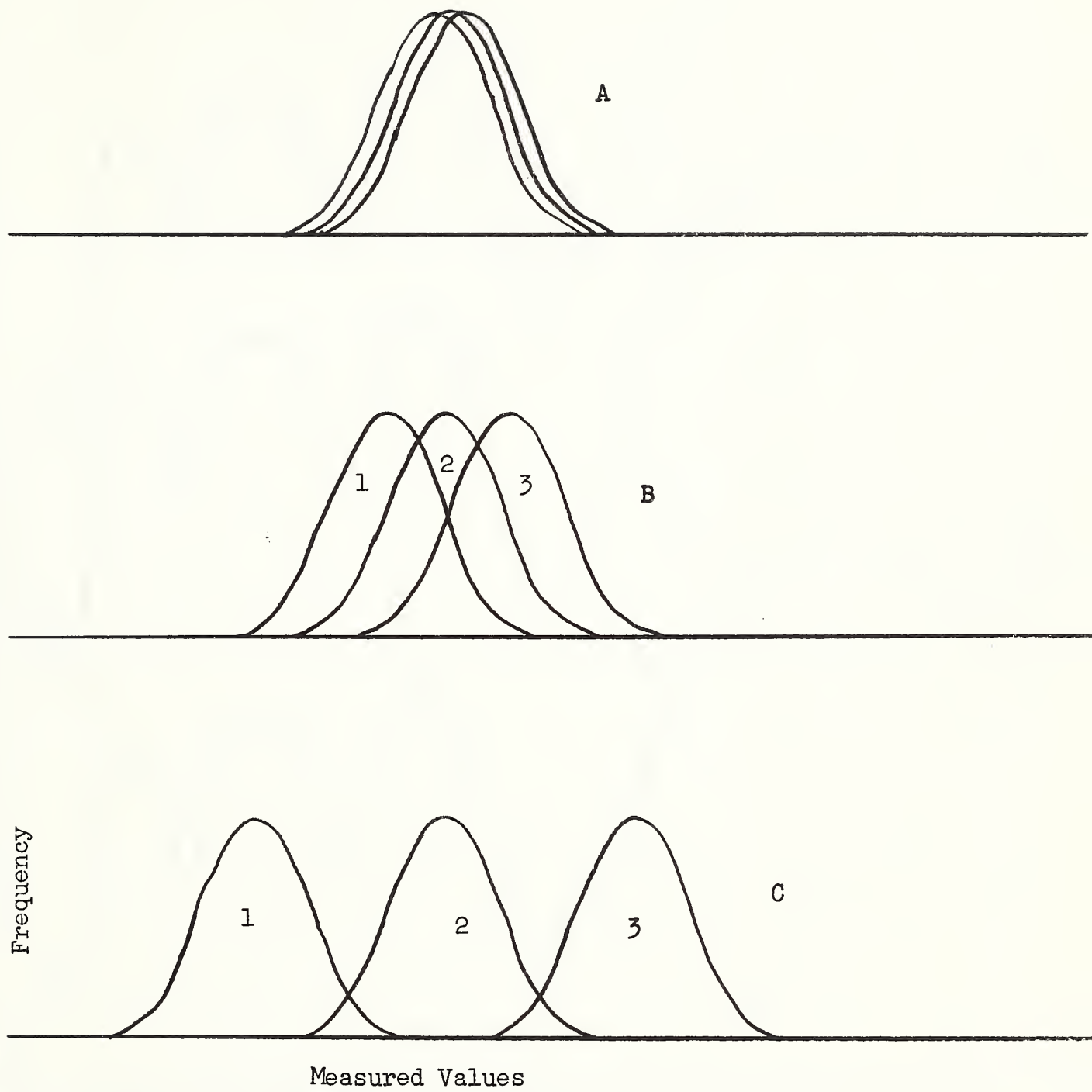


Figure 20. Theoretical Cases of Data Distribution

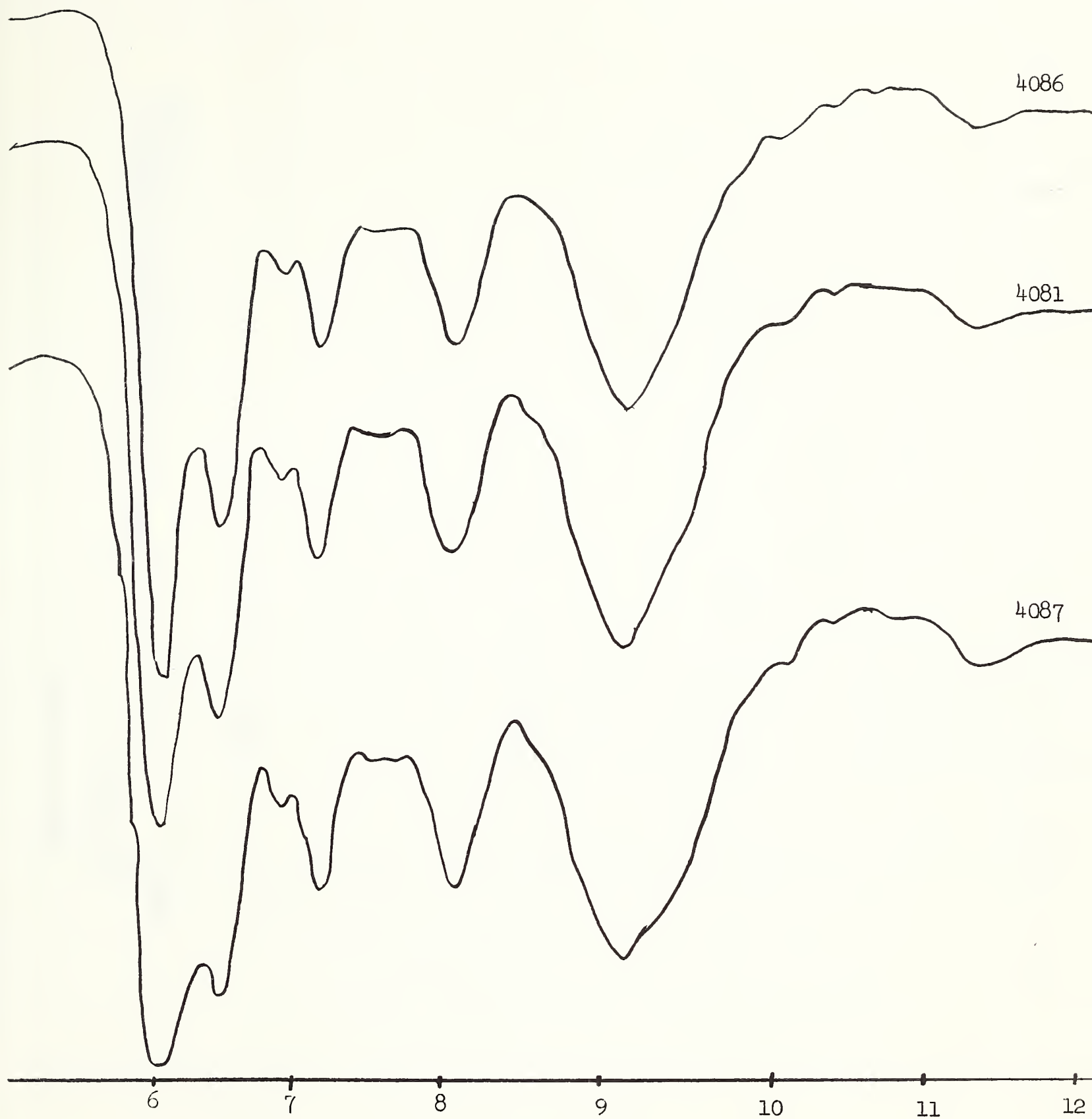


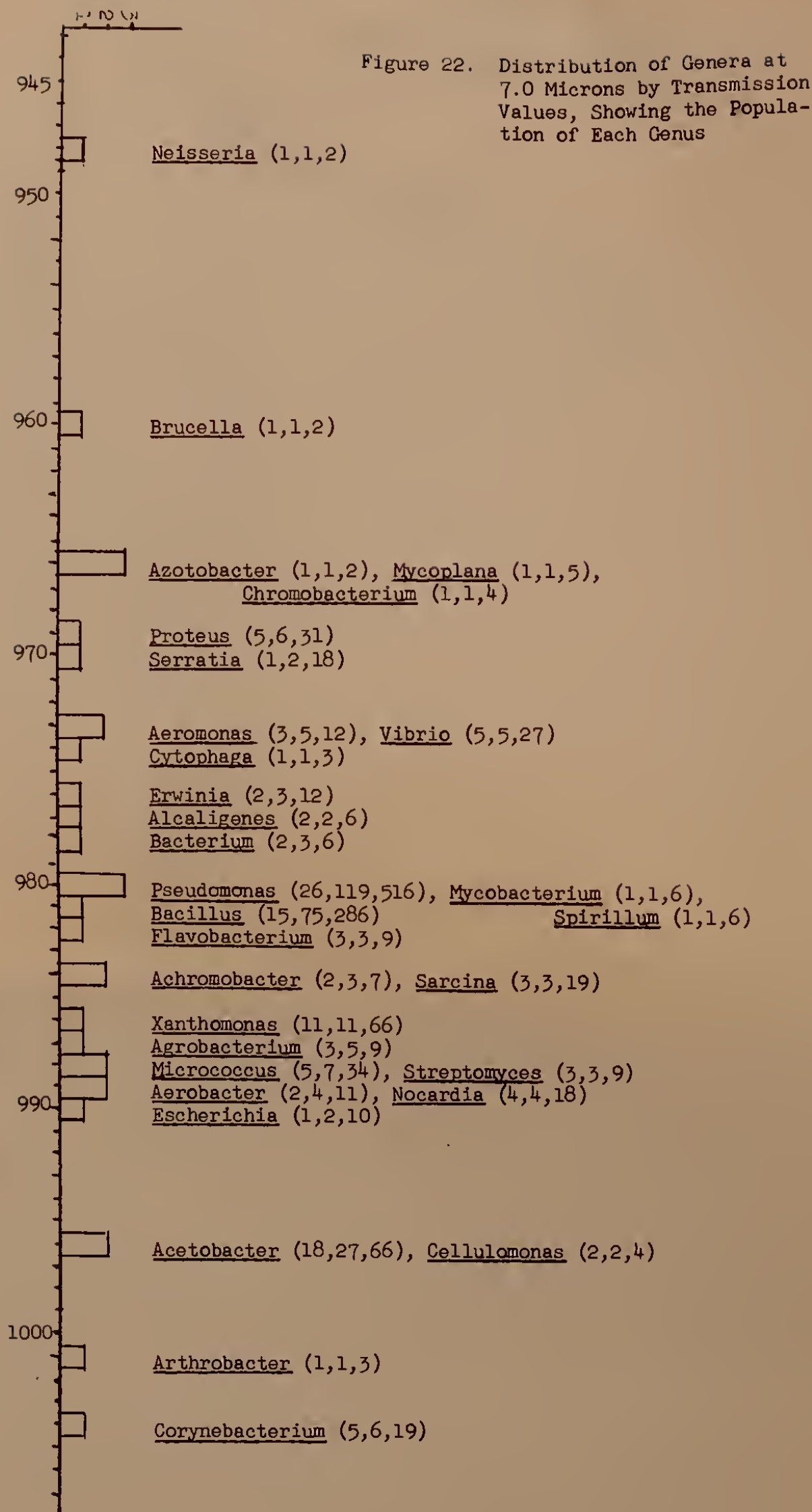
Figure 21. Thin, Standard and Thick Films Used in Evaluating Transmission Data Method

Number of Genera



Figure 22. Distribution of Genera at 7.0 Microns by Transmission

Number of Genera



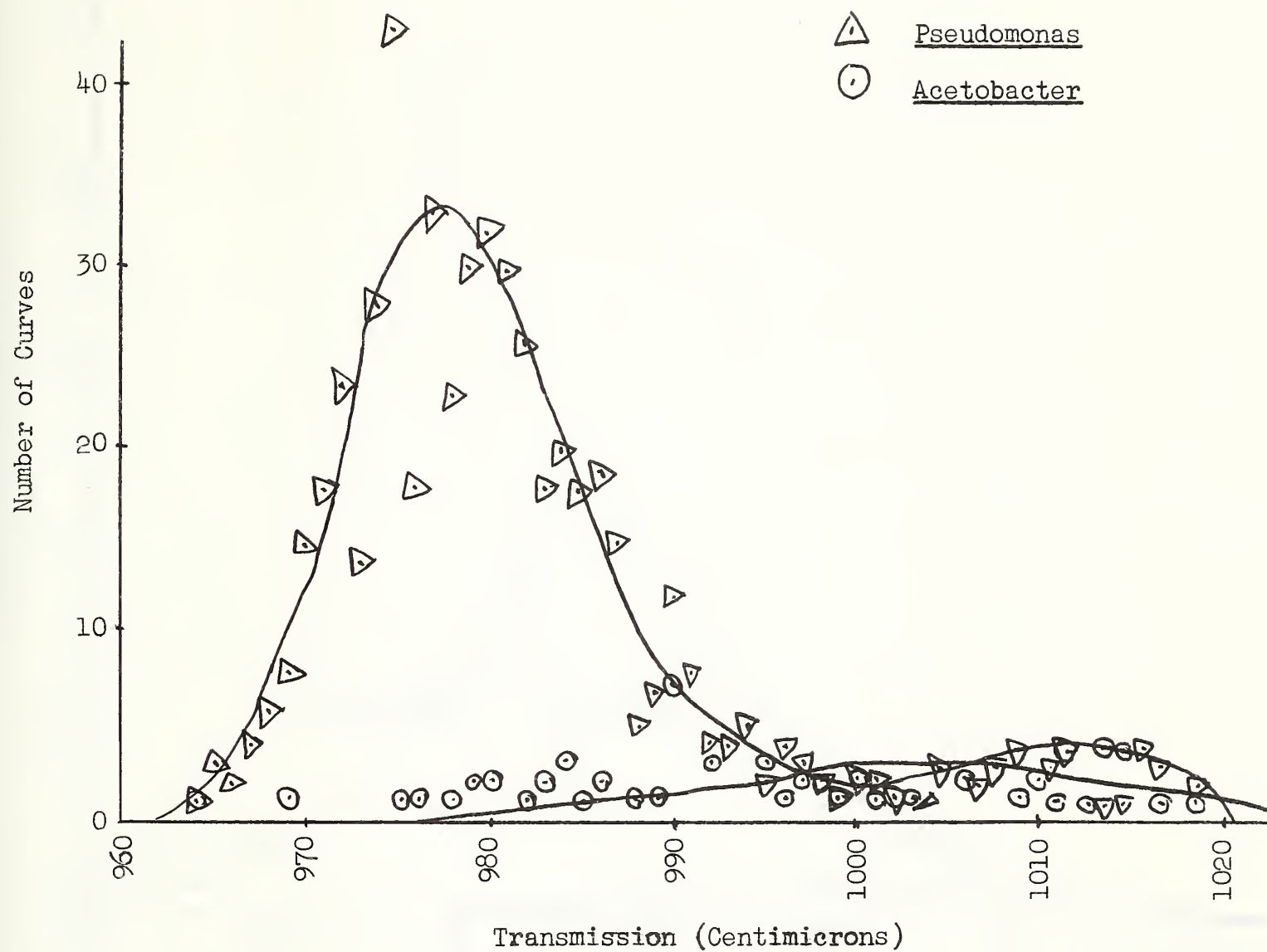


Figure 23. Distribution of Transmission Data by Individual Curves of Pseudomonas and Acetobacter at 7.0 Microns

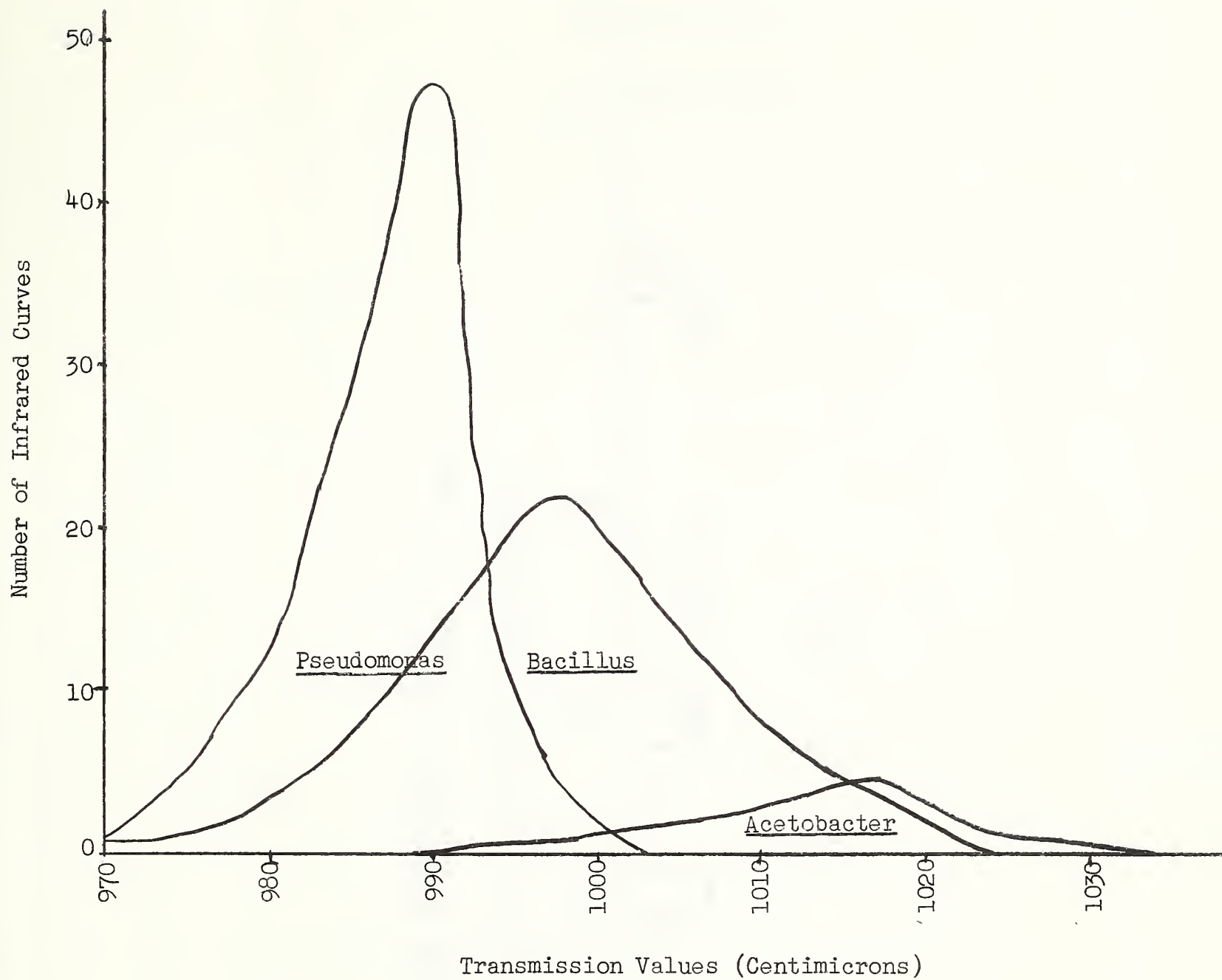


Figure 24. Distribution of Curve Transmission Data of Acetobacter, Bacillus, and Pseudomonas at 8.5 Microns



Figure 1. A graph showing two overlapping bell-shaped curves. The x-axis is labeled with values 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. The y-axis is labeled with values 1, 2, 3, 4, 5, 6, 7, 8, 9, 10. The curves are drawn with a single continuous line, showing their relative positions and widths.

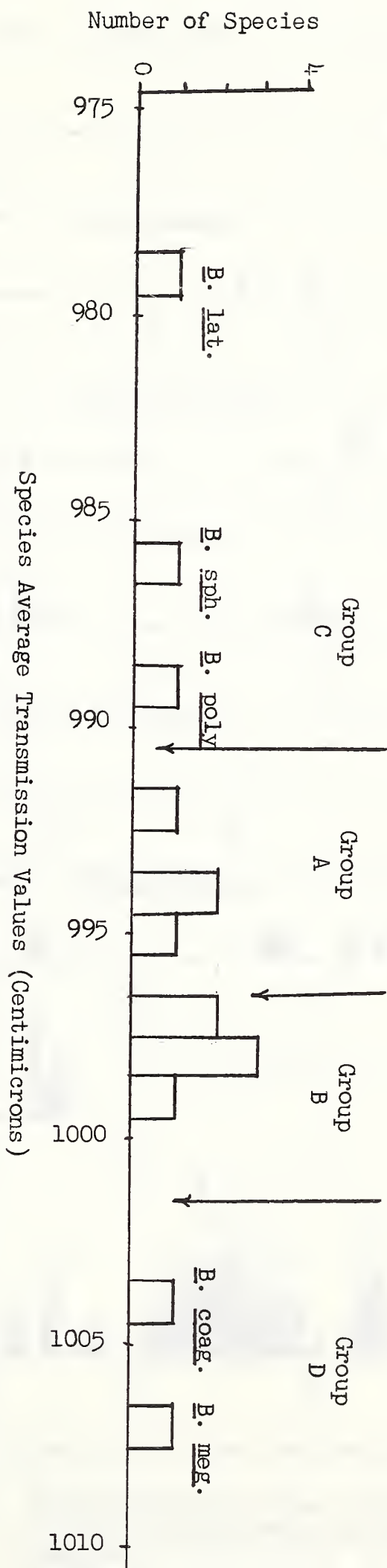


Figure 25. Bacillus. Distribution of Species Average Transmission Data at 8.5 Microns

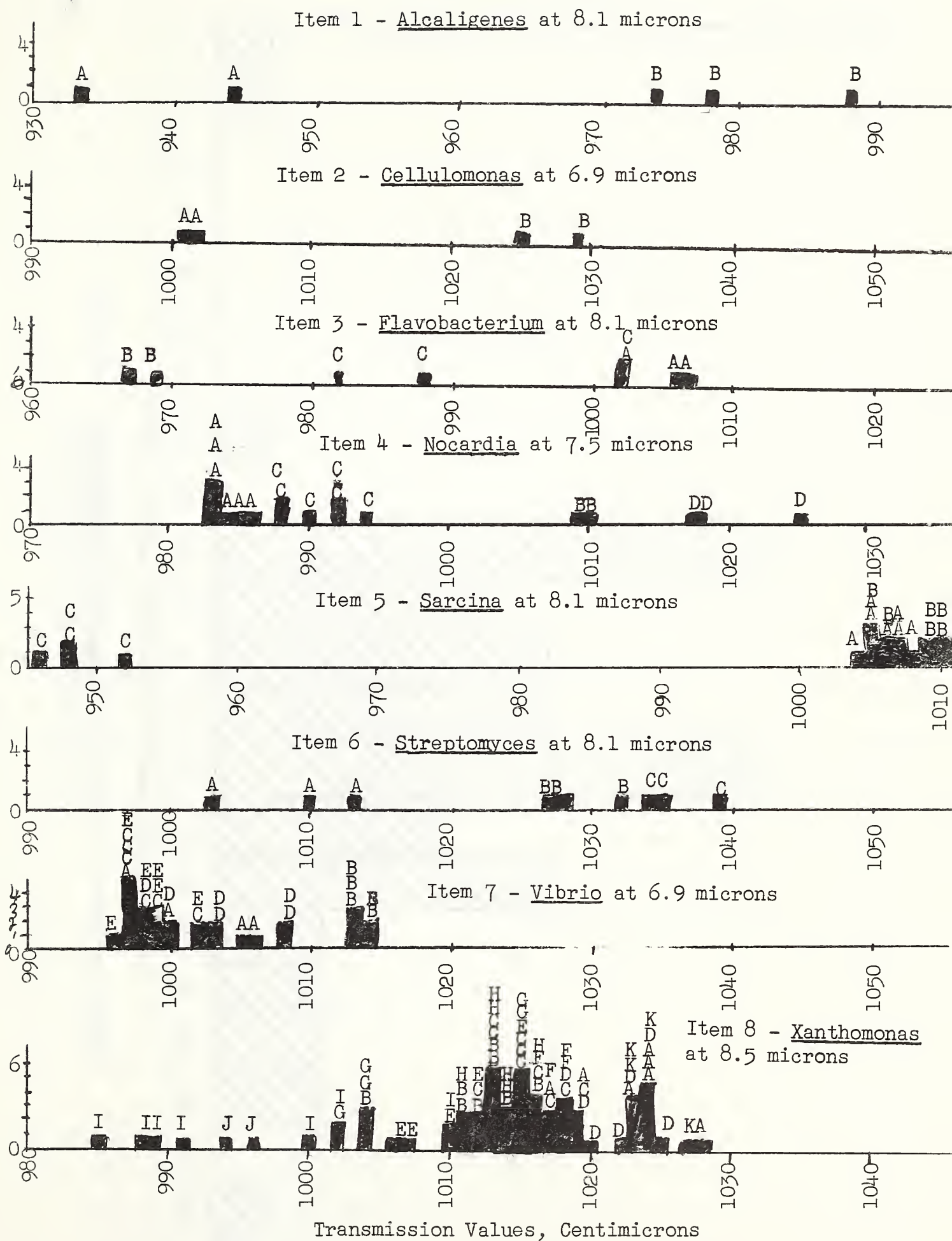


Figure 26. Distribution of curves, transmission data in genera having only one strain per species

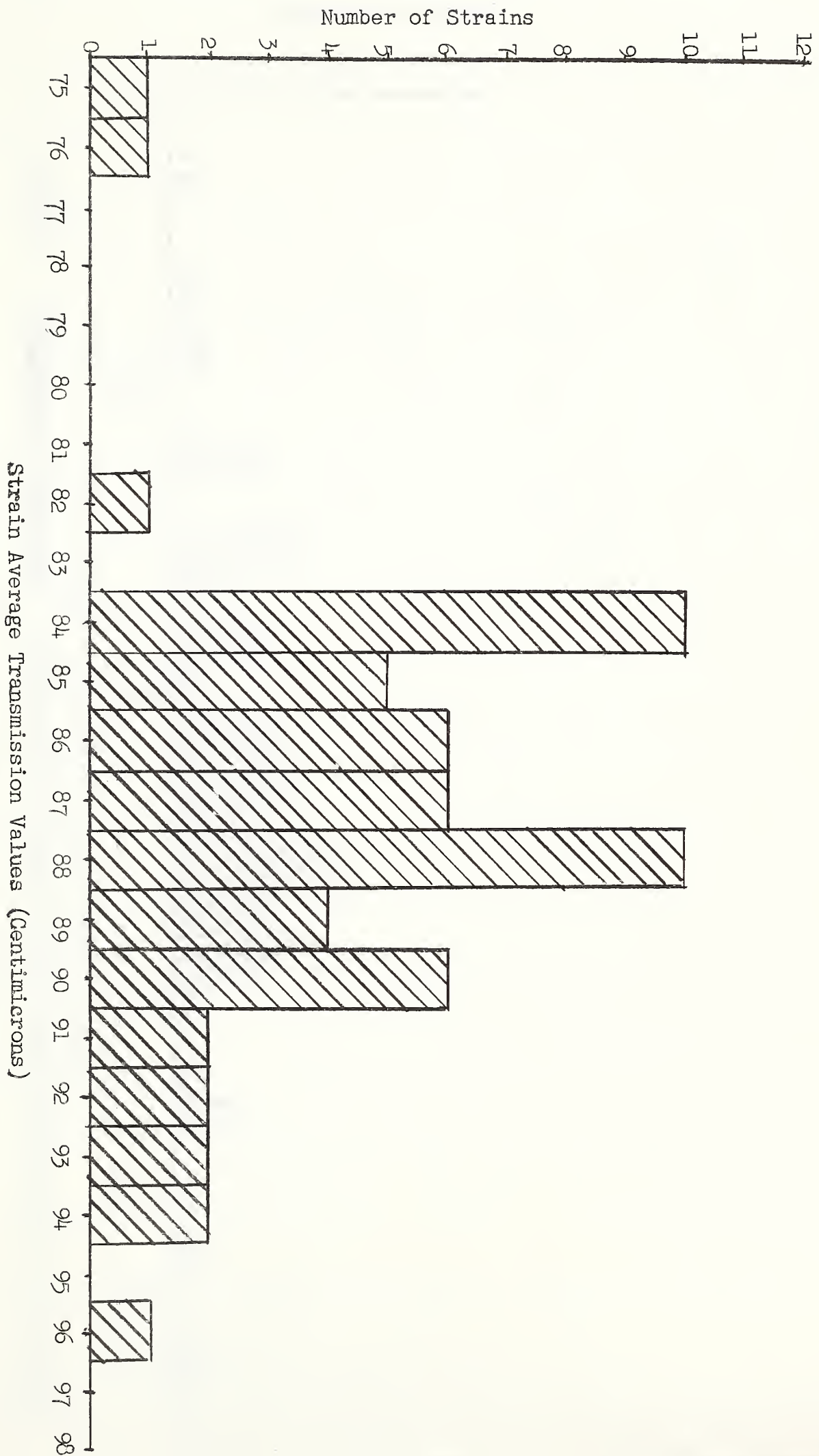
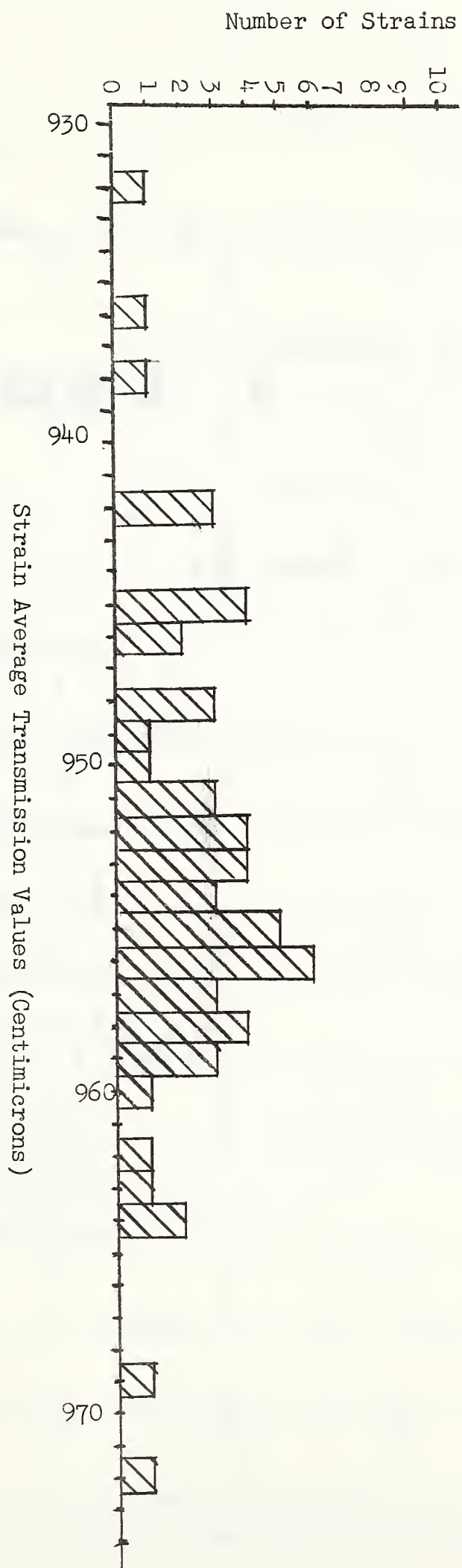
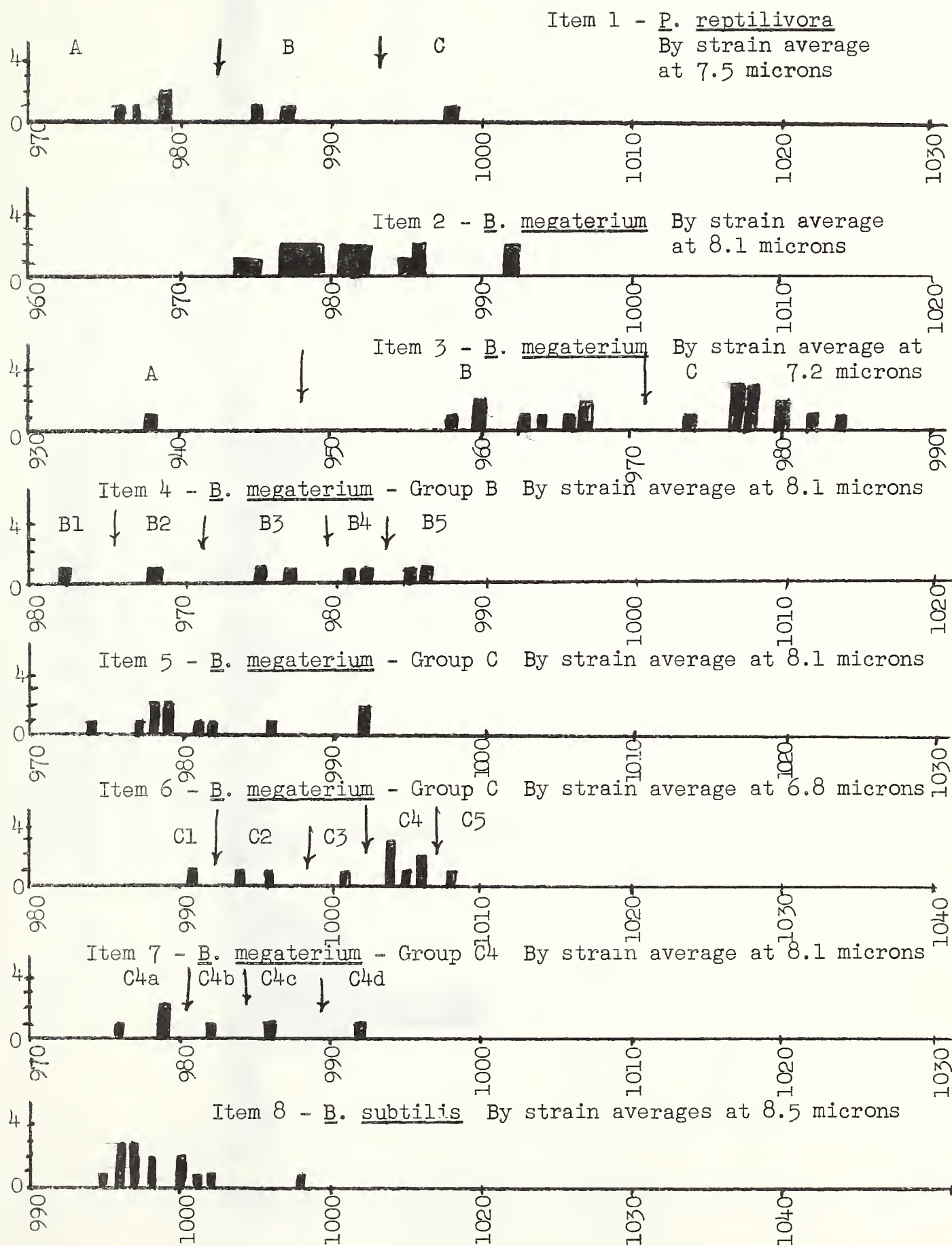


Figure 27. Pseudomonas aeruginosa, Distribution of Strain Averages Transmission Data at 8.5 Microns

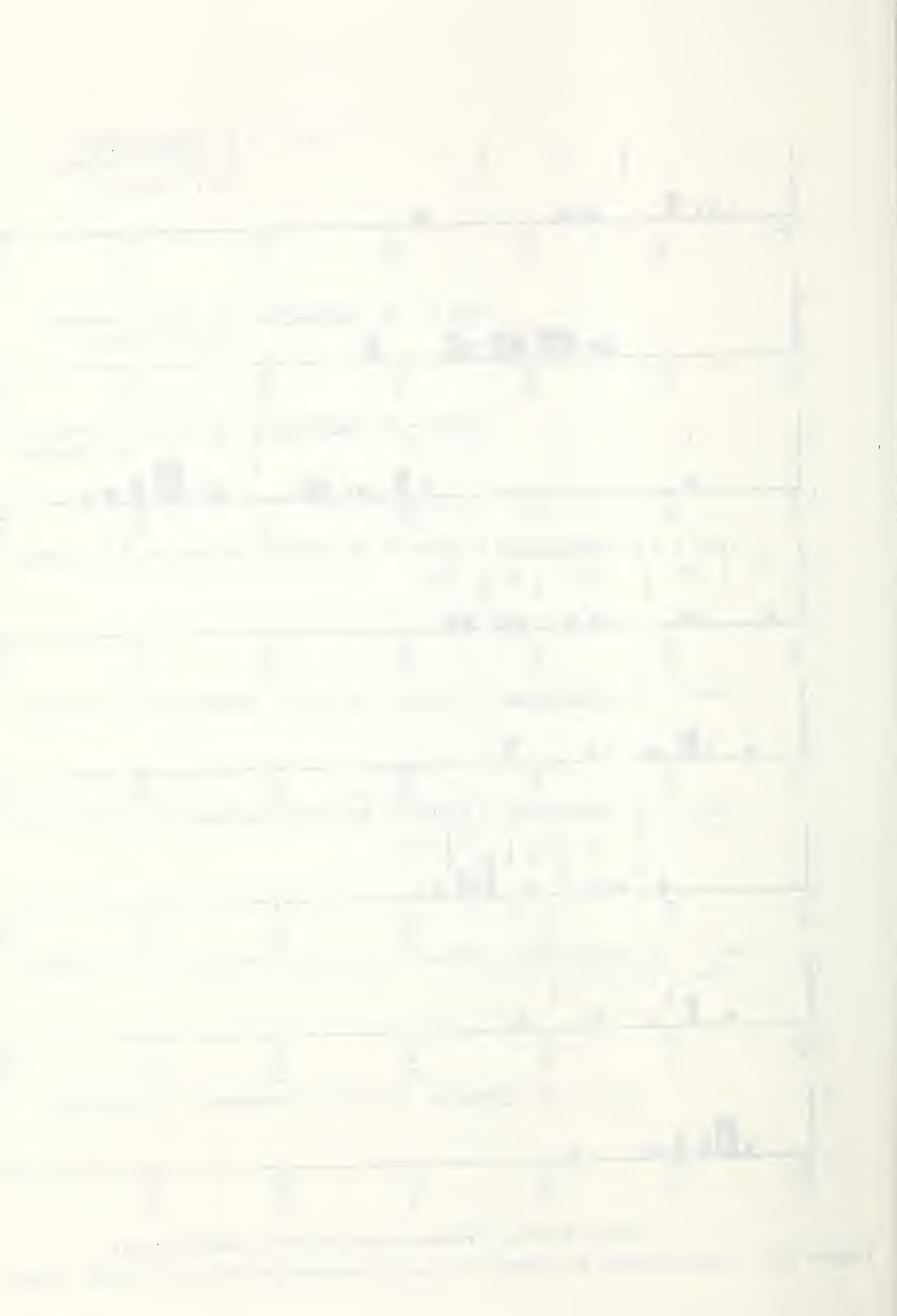
Figure 28. Pseudomonas aeruginosa. Distribution of Strain Average Transmission Data at 8.1 Microns

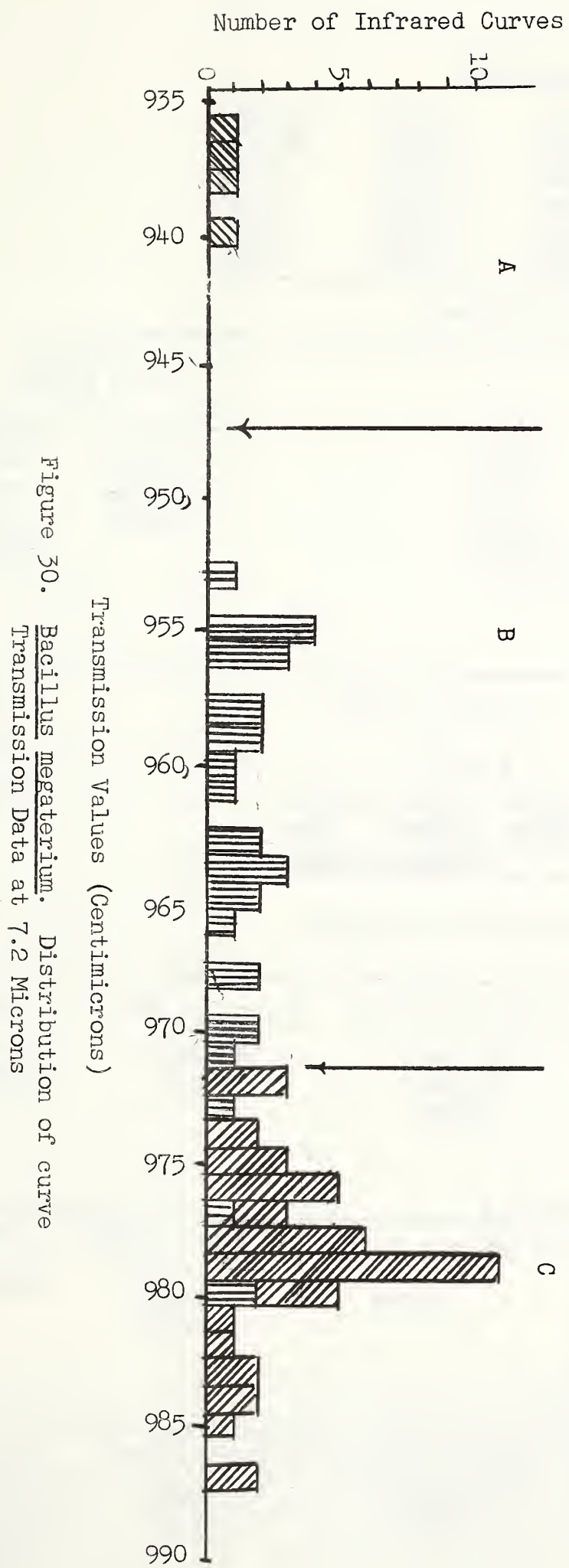




Strain Average Transmission Values (Centimicrons)

Figure 29. Distributions by Strain Average Transmission Data of Various Groups of Strains





Bacillus megaterium

NRS245	B353	NRS822	NRS872	NRS923
NRS308	NRS607	NRS824	NRS892	NRS931
B349	NRS608	NRS828	NRS893	B938
B350	NRS610	NRS829	NRS894	NRS951
B351	NRS623	NRS835	NRS895	NRS952
B352	NRS627	NRS837	NRS907	

Sorted at 5.7 microns

With 5.7 micron band		Without 5.7 micron band			
NRS245	NRS894	NRS308	NRS610	NRS828	NRS892
B349	B938	B350	NRS623	NRS829	NRS895
B352	NRS951	B351	NRS627	NRS835	NRS907
B353	NRS952	NRS607	NRS822	NRS837	NRS923
NRS893		NRS608	NRS824	NRS872	NRS931

Sorted at 7.2 microns

< 947.5	> 947.5, < 971.5	> 971.5
Group A	Group B	Group C
B351	NRS308 NRS872 NRS923 B350 NRS892 NRS931 NRS627 NRS895	NRS607 NRS623 NRS828 NRS837 NRS608 NRS822 NRS829 NRS907 NRS610 NRS824 NRS835

Sorted at 8.1 microns

< 965.5	> 965.5, < 971.5	> 971.5, < 979.5	> 979.5, < 983.5	> 983.5
Group B1	Group B2	Group B3	Group B4	Group B5
NRS931	NRS892	NRS308 NRS895	B350 NRS872	NRS627 NRS923

Sorted at 6.8 microns

< 992.5	> 992.5, < 998.5	> 998.5, < 1,002.5	> 1,002.5, < 1,007.5	> 1,007.5
Group C1	Group C2	Group C3	Group C4	Group C5
NRS822	NRS607 NRS824	NRS623	NRS608 NRS610 NRS828 NRS835 NRS837 NRS907	NRS829

Sorted at 8.1 microns

< 980.5	> 980.5, < 984.5	> 984.5, < 989.5	> 989.5
Group C4a	Group C4b	Group C4c	Group C4d
NRS610 NRS835 NRS837	NRS907	NRS828	NRS608

Figure 31. Sorting Program for Strains of Bacillus megaterium

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var. :
	Var. :
	F
	S.D. :

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var. :
	Var. :
	F
	S.D. :

^a Average of strain av

^b Average of strain va

^c Variance of strain a

^d Standard deviation c

Table 10 (Page 1)

AVERAGES OF TRANSMISSION VALUES FOR EACH SPECIES TOGETHER WITH THEIR VARIANCES,
"F" RATIOS, AND STANDARD DEVIATION

Species		Wavelength in microns										Group	F ratio that would be exceeded 1% of time by chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Pseudomonas</u>	(Av.) ^a	(941.39)	(900.47)	982.47	969.59	977.80	964.27	986.59	953.0	987.25	59, 235		
<u>aeruginosa</u>	Var. 1 ^b	55.25	79.66	8.73	10.10	8.51	14.47	6.92	17.88	3.95			
	Var. 2 ^c	337.66	846.86	100.02	109.80	72.22	102.42	55.90	221.38	56.39			
	F	6.11	10.63	11.46	10.87	8.48	7.08	8.08	12.38	14.28			1.47
	S.D. 2 ^d	18.3	29.1	10.0	10.5	8.5	10.1	7.5	14.8	7.5			
<u>Pseudomonas</u>	(Av.)	(940.0)	(886.0)	978.86	966.43	976.14	962.86	985.43	946.86	983.0	7, 28		
<u>reptilivora</u>	Var. 1	115.57	152.71	27.0	25.57	14.14	21.71	15.0	58.19	4.33			
	Var. 2	677.33	1,345.40	671.80	446.97	263.28	366.91	397.38	839.36	241.35			3.81
	F	5.86	8.81	24.88	17.48	18.62	16.90	26.49	14.42	55.74			
	S.D. 2	26.0	36.7	25.9	21.2	10.2	19.2	19.9	29.0	15.5			
<u>Pseudomonas</u>	(Av.)	960.8	(896.8)	987.8	974.8	983.6	973.4	992	952.4	986.2	5, 30		
<u>chlororaphis</u>	Var. 1	68.40	243.20	22.24	13.90	13.80	20.46	20.14	41.24	8.04			
	Var. 2	78.8	302.8	28.8	12.8	13.2	33.2	22.0	89.2	51.8			4.89
	F	1.15	1.25	1.29	0.92	0.96	1.62	1.09	2.16	6.44			
	S.D. 2	8.8	17.4	5.4	3.6	3.6	5.8	4.7	9.4	7.2			
<u>Pseudomonas</u>	(Av.)	965.2	(914.6)	996.4	980.2	990.0	978.2	1,002.6	957.6	993.8	5, 23		
<u>eisenbergii</u>	Var. 1	19.98	27.18	45.58	9.24	45.88	12.22	62.30	32.84	17.70			
	Var. 2	720.8	1,133.2	1,037.2	388.8	422.0	246.8	1,129.2	1,089.2	334.8			4.89
	F	36.40	41.69	22.76	42.08	9.20	20.20	18.13	33.17	18.92			
	S.D. 2	26.8	33.6	32.1	19.7	20.5	15.7	33.6	33.0	18.3			

^a Average of strain averages for all strains of the species.

^b Average of strain variances for all strains of the species.

^c Variance of strain averages in species.

^d Standard deviation of strain averages in species.

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain av

b Average of strain ve

c Variance of strain e

d Standard deviation c

Table 10 (Page 2)

Species		Wavelength in microns										Group	F ratio that would be exceeded 1% of time by chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Pseudomonas fluorescens</u>	(Av.)	(956.8)	(906.6)	989.2	976.4	987.0	972.4	994.6	961.0	996.2	5, 21		
	Var. 1	295.40	314.34	87.88	89.32	55.44	107.74	55.54	139.34	22.86			
	Var. 2	2,014.8	2,095.2	1,328.8	1,121.2	1,150.0	1,067.2	891.2	1,516.0	1,092.8			
	F	6.81	6.66	15.12	12.55	20.74	9.90	16.05	10.88	47.80		4.89	
	S.D. 2	44.8	45.7	36.4	33.4	33.9	32.6	29.8	38.8	33.0			
<u>Pseudomonas iodina</u>	(Av.)	(947.5)	(929.0)	989.5	979.75	984.5	970.75	996.25	976.25	1,002.5	4, 16		
	Var. 1	157.08	213.92	44.50	26.68	35.18	68.32	41.72	13.18	9.75			
	Var. 2	396.00	408.00	36.00	52.00	38.67	185.33	60.00	28.00	13.33			
	F	2.52	1.91	0.79	1.95	1.10	2.71	1.44	2.13	1.37		5.95	
	S.D. 2	19.9	20.2	6.0	7.1	6.2	13.6	7.7	5.3	3.6			
<u>Pseudomonas acidovorans</u>	(Av.)	(943.5)	(885.5)	979.5	966.0	976.5	963.0	985.0	955.0	987.5	2, 11		
	Var. 1	37.65	361.5	23.0	30.25	11.45	29.75	10.35	32.6	3.65			
	Var. 2	338.0	50.0	98.0	128.0	50.0	128.0	32.0	8.0	2.0			
	F	3.98	0.14	4.6	4.23	4.37	4.30	3.09	0.25	0.55		13.7	
	S.D. 2	18.4	7.1	9.9	13.0	7.1	13.0	3.8	2.8	1.4			
<u>Pseudomonas angulata</u>	(Av.)	966.00	(929.00)	1,001.00	986.00	992.00	980.33	1,004.33	976.33	1,009.67	3, 19		
	Var. 1	44.00	94.67	6.00	13.33	23.67	10.00	11.00	18.67	3.67			
	Var. 2	1,228.0	2,628.0	756.0	388.0	400.0	424.0	628.0	726.0	562.0			
	F	27.91	27.76	126.00	29.11	16.90	42.40	57.09	38.89	153.13		8.02	
	S. D. 2	35.0	51.2	27.4	19.7	20.0	20.6	25.0	26.9	23.7			
<u>Pseudomonas caviae</u>	(Av.)	(943.33)	(889.00)	985.33	974.67	980.67	966.67	992.00	955.67	993.00	3, 8		
	Var. 1	210.00	435.67	92.67	55.00	67.00	63.00	239.33	89.67	165.67			
	Var. 2	347.06	252.00	24.74	62.34	14.10	62.66	124.00	119.10	76.60			
	F	1.65	0.58	0.27	1.13	0.21	0.99	0.52	1.33	0.46		8.02	
	S.D. 2	18.6	15.9	5.0	7.9	3.8	7.9	11.1	10.9	8.7			

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 10 (Page 3)

Species		Wavelength in microns										Group	F ratio that would be exceeded 1% of time by chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Pseudomonas</u> <u>allicola</u>	(Av.)	(939.0)	(893.0)	980.0	967.0	976.0	954.5	984.5	954.0	985.0	2, 8		
	Var. 1	80.65	169.70	29.15	47.15	21.15	94.00	15.00	40.00	4.00			
	Var. 2	1,800.0	5,000.0	32.0	72.0	72.0	724.0	20.0	288.0	72.0			
	F	22.32	29.46	1.10	1.53	3.40	7.70	1.33	7.20	18.0		13.7	
	S.D. 2	42.4	70.7	5.6	8.5	8.5	26.9	16.9	16.9	8.5			
<u>Pseudomonas</u> <u>atrofaciens</u>	(Av.)	957.5	(918.5)	988.0	977.0	983.0	974.0	990.5	961.5	992.5	2, 7		
	Var. 1	29.5	65.5	21.5	9.5	8.0	15.0	15.5	56.5	26.0			
	Var. 2	98.0	162.0	8.0	8.0	32.0	0.0	22.0	242.0	242.0			
	F	3.32	2.47	0.37	0.84	4.00	0.00	1.42	4.28	9.31		13.7	
	S.D. 2	9.9	12.7	2.8	2.8	5.6	0.0	4.7	15.5	15.5			
<u>Pseudomonas</u> <u>boreopolis</u>	(Av.)	(935.5)	(889.0)	973.5	959.5	970.0	957.0	980.5	947.5	982.5	2, 6		
	Var. 1	46.5	47.5	2.5	5.0	5.5	3.5	0.5	4.5	3.0			
	Var. 2	2.0	8.0	98.0	18.0	0.0	8.0	50.0	2.0	162.0			
	F	0.04	0.17	39.20	3.60	0.00	2.29	100.00	0.44	54.00		13.7	
	S.D. 2	1.4	2.8	9.9	4.2	0.0	2.8	7.1	1.4	12.7			
<u>Pseudomonas</u> <u>calco-acetica</u>	(Av.)	(956.0)	(925.5)	1,000.5	988.0	994.0	976.0	1,000.0	973.0	1,006.5	2, 12		
	Var. 1	58.0	95.5	3.5	89.0	5.0	54.5	2.0	96.0	5.0			
	Var. 2	4,608.0	9,522.0	4,050.0	3,528.0	3,872.0	2,312.0	3,200.0	3,528.0	3,362.0			
	F	79.45	99.71	1,157.14	39.64	774.40	42.42	1,600.00	36.75	672.40		13.7	
	S.D. 2	67.8	97.3	63.5	59.4	62.2	48.0	56.5	59.3	58.0			
<u>Pseudomonas</u> <u>mildenbergii</u>	(Av.)	949.0	(898.0)	974.5	966.5	974.5	965.5	983.0	943.0	980.0	2, 11		
	Var. 1	25.10	87.15	16.65	19.80	6.70	16.60	11.50	36.25	13.00			
	Var. 2	200.0	128.0	18.0	50.0	18.0	162.0	32.0	32.0	8.0			
	F	7.97	1.47	1.08	2.53	2.69	9.76	2.78	0.88	0.62		13.7	
	S.D. 2	14.1	11.3	4.2	7.1	4.2	12.7	5.6	5.6	2.8			

Species

Pseudomonas (Av.)
aeruginosa Var.
Var.
F
S.D.

Pseudomonas (Av.)
reptilivora Var.
Var.
F
S.D.

Pseudomonas (Av.)
chlororaphis Var.
Var.
F
S.D.

Pseudomonas (Av.)
eisenbergii Var.
Var.
F
S.D.

a Average of strain av

b Average of strain ve

c Variance of strain a

d Standard deviation c

Table 10 (Page 4)

Species		Wavelength in microns										Group	: F ratio : that : would be : exceeded : 1% of : time by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Pseudomonas</u> <u>pavonacea</u>	(Av.)	967.5	(917.0)	996.0	981.0	988.0	979.0	996.0	960.5	993.0	2, 7		
	Var. 1	46.00	16.00	54.50	11.50	20.85	24.00	50.00	8.00	12.05			
	Var. 2	722.0	968.0	1,352.0	512.0	288.0	392.0	392.0	2,178.0	968.0			
	F	15.70	60.5	24.81	44.52	13.81	16.33	7.84	272.25	80.33		13.7	
	S.D. 2	26.9	31.1	36.6	22.6	17.0	19.8	19.8	46.6	31.1			
<u>Pseudomonas</u> <u>putida</u>	(Av.)	(950.5)	(890.0)	988.5	973.5	983.5	968.5	995.5	950.0	990.5	2, 14		
	Var. 1	285.5	213.5	393.0	145.5	198.0	134.5	286.0	183.5	113.5			
	Var. 2	50.0	392.0	98.0	50.0	18.0	18.0	162.0	8.0	2.0			
	F	0.18	1.84	0.25	0.34	0.09	0.13	0.57	0.04	0.02		13.7	
	S.D. 2	7.1	19.8	9.9	7.1	4.2	4.2	12.7	2.8	1.4			
<u>Pseudomonas</u> <u>stutzeri</u>	(Av.)	(965.5)	(924.0)	1,008.0	986.0	995.0	979.5	1,007.5	972.0	1,005.0	2, 17		
	Var. 1	163.5	402.5	207.0	99.5	94.0	65.0	139.5	50.0	40.0			
	Var. 2	1,250.0	3,872.0	648.0	648.0	968.0	578.0	578.0	392.0	968.0			
	F	7.65	9.62	3.13	6.51	10.30	8.89	4.14	7.84	24.20		13.7	
	S.D. 2	35.3	62.2	25.4	25.4	31.1	24.0	24.0	19.8	31.1			
<u>Bacillus</u> <u>megaterium</u>	(Av.)	(945.60)	(936.55)	998.00	985.30	987.90	(970.40)	996.35	978.95	1,007.45	20, 80		
	Var. 1	116.10	93.10	39.20	17.00	16.35	27.85	21.50	8.05	15.00			
	Var. 2	425.43	716.42	253.89	164.25	151.54	500.80	126.44	243.16	88.21			
	F	3.66	7.70	6.48	9.66	9.27	17.98	5.88	30.21	5.88		2.20	
	S. D. 2	20.6	26.7	15.9	12.8	12.3	22.4	11.2	15.6	9.4			
<u>Bacillus</u> <u>subtilis</u>	(Av.)	(919.21)	(874.00)	987.21	977.86	981.79	957.64	989.79	968.50	998.64	14, 57		
	Var. 1	100.86	274.93	9.29	7.86	10.31	24.86	5.21	11.86	3.02			
	Var. 2	774.99	1,691.07	84.58	97.69	86.95	259.64	54.04	103.23	48.95			
	F	7.68	6.15	9.10	12.43	8.43	10.44	10.37	8.70	16.21		2.66	
	S.D. 2	27.8	41.1	9.2	9.9	9.3	16.1	7.3	101	7.0			

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain av

b Average of strain va

c Variance of strain a

d Standard deviation c

Table 10 (Page 5)

Species		Wavelength in microns										Group	F ratio that would be exceeded 1% of time by chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Bacillus</u>	(Av.)	(916.75)	(877.75)	962.25	949.25	960.75	(936.50)	970.5	(938.50)	978.75	4, 11		
<u>laterosporus</u>	Var. 1	122.25	172.50	81.25	125.25	70.75	119.75	47.00	55.00	6.75			
	Var. 2	179.67	249.00	219.67	417.00	169.00	238.67	161.33	214.67	67.67			
	F	1.47	1.44	2.70	3.33	2.39	1.99	3.43	3.90	10.02		5.95	
	S.D. 2	13.4	15.8	14.8	20.4	13.0	15.4	12.7	14.6	8.2			
<u>Bacillus</u>	(Av.)	(957.25)	(924.75)	1,000.25	985.50	989.50	977.25	1,003.50	966.00	997.75	4, 14		
<u>pantothenticus</u>	Var. 1	499.00	472.00	273.25	83.75	69.50	137.50	156.75	109.75	45.25			
	Var. 2	219.68	131.68	491.68	156.00	76.00	35.68	420.00	258.67	387.68			
	F	0.44	0.28	1.80	1.86	1.09	0.26	2.68	2.36	8.57		5.95	
	S.D. 2	14.8	11.4	22.2	12.5	8.7	6.0	20.5	16.1	19.7			
<u>Bacillus</u>	(Av.)	(927.75)	(893.00)	977.00	969.00	975.00	953.00	984.00	957.75	989.25	4, 15		
<u>polymyxa</u>	Var. 1	127.00	236.00	32.00	37.25	31.00	98.25	34.50	79.25	8.25			
	Var. 2	683.68	802.67	32.00	98.67	48.00	240.00	32.00	102.35	22.35			
	F	5.38	3.40	1.00	2.65	1.55	2.44	0.93	1.29	2.71		5.95	
	S.D. 2	26.1	28.3	5.6	9.9	6.9	15.5	5.6	10.1	4.7			
<u>Bacillus</u>	(Av.)	(922.75)	(897.50)	979.25	969.75	973.75	(947.25)	983.00	961.00	994.50	4, 17		
<u>pumilus</u>	Var. 1	83.75	160.25	19.00	32.25	19.50	44.75	11.50	27.50	2.75			
	Var. 2	185.01	321.33	19.68	75.68	25.01	89.01	18.67	2.67	12.00			
	F	2.21	2.01	1.04	2.35	1.28	1.99	1.62	0.10	4.36		5.95	
	S.D. 2	13.6	17.9	4.4	8.7	5.0	9.4	4.3	1.6	3.5			
<u>Bacillus</u>	(Av.)	(917.50)	(868.50)	973.25	960.00	968.25	(945.00)	980.50	955.25	986.50	4, 16		
<u>sphaericus</u>	Var. 1	137.00	340.50	41.75	59.00	35.25	81.50	18.50	50.00	7.00			
	Var. 2	433.33	230.67	81.01	205.33	86.35	325.33	6.67	190.35	33.33			
	F	3.16	0.68	1.94	3.48	2.45	3.99	0.36	3.81	4.76		5.95	
	S.D. 2	20.8	15.2	9.0	14.3	9.3	18.0	2.6	13.8	5.8			

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain at

b Average of strain va

c Variance of strain a

d Standard deviation c

Table 10 (Page 6)

Species		Wavelength in microns										Group	F ratio that would be exceeded 1% of time by chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Bacillus alvei</u>	(Av.)	(938.67)	(908.67)	988.33	974.67	979.33	962.33	990.67	974.33	997.00	3, 15		
	Var. 1	165.67	111.00	126.67	89.00	53.00	122.33	67.33	87.33	49.00			
	Var. 2	1,045.18	1,080.94	217.68	357.04	257.64	545.58	196.96	449.64	108.00			
	F	6.31	9.74	1.72	4.01	4.86	4.46	2.93	5.15	2.20		8.02	
	S.D. 2	32.3	32.8	14.7	18.9	16.0	23.3	14.0	21.2	10.4			
<u>Bacillus <u>circulans</u></u>	(Av.)	(944.00)	(913.33)	988.67	976.67	980.00	963.00	991.33	971.00	994.00	3, 14		
	Var. 1	76.33	239.00	58.67	36.33	77.67	49.00	34.00	57.67	33.33			
	Var. 2	2,958.00	4,185.86	854.58	854.26	676.00	1,524.00	580.98	700.00	196.00			
	F	38.75	17.51	14.57	23.51	8.70	31.10	17.09	12.14	5.88		8.02	
	S.D. 2	54.4	64.6	29.2	29.2	26.00	39.0	24.1	26.4	14.0			
<u>Bacillus <u>coagulans</u></u>	(Av.)	974.33	(942.67)	1,006.00	994.00	997.00	985.33	1,007.00	977.00	1,003.67	3, 11		
	Var. 1	77.67	259.67	59.67	41.67	36.67	20.67	36.00	23.00	5.33			
	Var. 2	210.30	55.62	124.00	52.00	52.00	40.74	36.00	12.00	117.18			
	F	2.71	0.21	2.08	1.25	1.42	1.97	1.00	0.52	1.13		8.02	
	S.D. 2	14.5	7.4	11.1	7.2	7.2	6.4	6.0	3.5	10.7			
<u>Bacillus <u>licheniformis</u></u>	(Av.)	(921.67)	(890.33)	984.67	974.33	979.33	949.67	986.33	965.00	998.00	3, 12		
	Var. 1	39.33	140.00	12.67	16.33	11.67	50.33	10.67	11.33	9.67			
	Var. 2	400.46	548.94	77.94	124.30	124.50	215.34	52.78	172.00	64.00			
	F	10.18	3.92	6.15	7.61	10.67	4.28	4.95	15.18	6.62		8.02	
	S.D. 2	20.0	23.4	8.8	11.1	11.1	14.7	7.3	13.1	8.0			
<u>Bacillus <u>macerans</u></u>	(Av.)	(930.33)	(904.33)	981.00	973.67	979.33	956.33	985.33	964.00	992.33	3, 11		
	Var. 1	176.33	763.67	17.33	41.33	19.00	72.33	26.67	10.00	11.67			
	Var. 2	1,930.54	829.50	508.00	286.38	332.50	1,011.58	460.74	64.00	281.02			
	F	10.95	1.09	29.31	6.93	17.50	13.99	17.28	6.40	24.08		8.02	
	S.D. 2	43.9	28.8	22.5	16.9	18.2	31.8	21.4	8.0	16.7			

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 10 (Page 7)

Species		Wavelength in microns										Group	: F ratio : that : would be : exceeded : 1% of : time by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Bacillus</u> <u>firmus</u>	(Av.)	(948.0)	(920.5)	988.0	977.5	979.0	963.5	991.0	971.0	998.5	2, 6		
	Var. 1	10.0	52.0	41.0	29.0	36.0	60.0	38.0	39.0	76.0			
	Var. 2	3,528.0	1,082.0	968.0	882.0	648.0	1,458.0	648.0	1,352.0	18.0			
	F	352.80	32.35	23.60	30.41	18.00	24.30	17.05	34.67	0.06	13.7		
	S.D. 2	59.4	41.0	31.0	29.7	25.4	38.2	25.4	36.7	4.2			
<u>Bacillus</u> <u>lentus</u>	(Av.)	(934.5)	(901.5)	988.0	978.0	980.5	966.5	989.0	960.0	997.0	2, 3		
	Var. 1	50.0	8.0	2.0	0.0	1.0	8.0	1.0	18.0	61.0			
	Var. 2	162.0	98.0	72.0	32.0	98.0	18.0	72.0	8.0	392.0			
	F	3.24	12.25	36.00		98.00	2.25	72.00	0.44	6.43	13.7		
	S.D. 2	12.7	9.9	8.5	5.6	9.9	4.2	8.5	2.8	19.8			
<u>Bacillus</u> <u>pulvifaciens</u>	(Av.)	(941.0)	(906.5)	986.0	978.0	982.0	959.0	989.0	966.5	995.0	2, 4		
	Var. 1	16.5	132.5	1.0	1.0	1.0	1.5	3.0	3.5	4.5			
	Var. 2	2,312.0	6,498.0	1,152.0	800.0	648.0	1,352.0	648.0	1,082.0	72.0			
	F	140.12	49.04	1,152.00	800.00	648.00	901.33	216.00	480.57	16.00	13.7		
	S.D. 2	48.0	80.5	33.9	28.3	25.4	36.7	25.4	41.0	8.5			
<u>Acetobacter</u> <u>aceti</u>	(Av.)	995.5	982.5	1,020.5	1,001.0	1,000.0	994.5	1,008.5	993.0	1,022.0	2, 6		
	Var. 1	21.0	16.0	7.0	6.0	13.0	36.0	9.0	8.0	9.0			
	Var. 2	1,858.0	1,250.0	1,458.0	1,152.0	968.0	722.0	578.0	288.0	648.0			
	F	88.48	78.12	208.29	192.0	74.46	20.06	82.57	36.00	72.00	13.7		
	S.D. 2	43.1	35.3	38.2	33.9	31.1	26.8	24.0	16.9	25.4			
<u>Acetobacter</u> <u>acetoaum</u>	(Av.)	970.0	(915.5)	1,000.0	980.5	987.0	978.5	996.0	974.0	1,012.0	2, 5		
	Var. 1	1.0	124.5	28.0	4.5	2.5	1.0	4.0	2.0	10.5			
	Var. 2	512.0	3,362.0	512.0	102.0	72.0	162.0	72.0	272.0	8.0			
	F	512.00	27.00	18.29	36.00	28.80	162.00	18.00	136.00	0.76	13.7		
	S.D. 2	22.6	58.0	22.6	12.7	8.5	12.7	8.5	16.5	2.8			

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 10 (Page 8)

Species		Wavelength in microns										Group	: F ratio : that : would be : exceeded : 1% of : time by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Acetobacter</u> <u>acidum-</u> <u>mucosum</u>	(Av.)	:1,005.0	980.5	(1,048.0)	1,017.5	1,019.0	1,005.5	1,028.5	998.5	1,032.0	2, 3		
	Var. 1	: 32.0	18.0	42.0	50.0	42.0	13.0	18.0	0.0	1.0			
	Var. 2	:1,352.0	450.0	800.0	1,250.0	968.0	722.0	1,058.0	578.0	512.0			
	F	: 42.25	25.00	19.05	25.00	23.05	55.59	58.77		512.0		13.7	
	S.D. 2	: 36.7	21.2	28.2	35.3	31.1	26.9	32.7	24.0	22.6			
<u>Acetobacter</u> <u>ascendens</u>	(Av.)	: 979.5	(936.5)	1,016.0	991.0	993.0	987.0	1,002.5	984.0	1,016.0	2, 4		
	Var. 1	: 0.5	293.0	18.0	4.5	1.0	1.0	13.5	1.0	3.0			
	Var. 2	: 578.0	1,922.0	200.0	72.0	32.0	72.0	18.0	128.0	32.0			
	F	:1,156.00	6.56	11.11	16.00	32.00	72.00	1.33	128.00	10.67		13.7	
	S.D. 2	: 24.0	44.0	14.1	8.5	5.6	8.5	4.2	11.3	5.6			
<u>Acetobacter</u> <u>gluconicum</u>	(Av.)	: 967.0	(921.0)	993.5	982.5	985.5	976.5	993.0	976.5	997.0	2, 3		
	Var. 1	: 32.0	5.0	1.0	5.0	8.0	8.0	1.0	1.0	2.0			
	Var. 2	: 72.0	2,888.0	50.0	2.0	2.0	2.0	8.0	578.0	8.0			
	F	: 2.25	577.60	50.00	0.40	0.25	0.25	8.00	578.00	4.00		13.7	
	S.D. 2	: 8.5	53.8	7.1	1.4	1.4	1.4	2.8	24.0	2.8			
<u>Acetobacter</u> <u>rancens</u>	(Av.)	: 994.5	972.0	1,029.5	1,006.0	1,012.0	998.5	1,017.5	995.5	1,028.5	2, 6		
	Var. 1	: 11.0	7.0	35.0	54.0	8.5	26.5	22.0	14.0	25.5			
	Var. 2	: 2.0	8.0	2.0	8.0	0.0	2.0	18.0	2.0	98.0			
	F	: 0.18	1.14	0.06	0.15	0.00	0.08	0.82	0.14	3.84		13.7	
	S.D. 2	: 1.4	2.8	1.4	2.8	0.0	1.4	4.2	1.4	9.9			
<u>Acetobacter</u> <u>suboxydans</u>	(Av.)	: 981.5	(940.5)	1,023.0	993.5	997.0	987.5	1,012.0	985.0	1,023.5	2, 4		
	Var. 1	: 16.5	41.0	121.0	49.0	58.0	13.0	48.5	6.5	46.5			
	Var. 2	: 578.0	1,922.0	2,312.0	578.0	512.0	242.0	1,352.0	392.0	1,058.0			
	F	: 35.03	46.88	19.03	11.80	8.83	18.62	27.88	60.31	22.75		13.7	
	S.D. 2	: 24.0	44.0	48.0	24.0	22.6	15.5	36.7	19.8	32.7			

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain at

b Average of strain va

c Variance of strain a

d Standard deviation c

Table 10 (Page 9)

Species		Wavelength in microns										Group	: F ratio : that : would be : exceeded : 1% of : time by : chance
		: 6.3	: 6.5	: 6.8	: 6.9	: 7.0	: 7.2	: 7.5	: 8.1	: 8.5			
<u>Acetobacter</u> <u>turbidans</u>	(Av.)	: 978.0	(935.5)	1,016.0	989.0	996.0	985.5	1,016.5	978.0	1,027.0	2, 6		
	Var. 1	: 25.0	3.0	152.0	15.5	46.0	4.0	16.0	1.5	15.5			
	Var. 2	: 1,568.0	10,658.0	1,152.0	968.0	800.0	578.0	2.0	1,152.0	200.0			
	F	: 62.72	3,552.67	7.58	62.45	17.39	144.50	0.12	768.00	12.90		13.7	
	S.D. 2	: 39.5	103.0	33.8	31.2	2.82	24.0	1.4	33.8	14.1			
<u>Acetobacter</u> <u>xylinum</u>	(Av.)	: (960.5)	(940.5)	1,003.0	987.0	990.0	974.5	998.0	971.0	1,009.0	2, 7		
	Var. 1	: 34.0	498.0	54.5	37.0	17.5	49.0	14.5	22.0	4.0			
	Var. 2	: 20,402.0	27,378.0	8,712.0	6,728.0	4,608.0	8,450.0	3,872.0	9,800.0	4,232.0			
	F	: 600.06	54.98	159.85	181.64	263.31	172.45	267.03	445.45	1,058.00		13.7	
	S.D. 2	: 142.9	165.2	93.0	82.0	67.8	91.8	62.2	99.0	65.0			
<u>Micrococcus</u> <u>pyogenes</u>	(Av.)	: (940.67)	(909.67)	985.67	976.33	980.67	959.33	990.00	952.33	994.67	3, 12		
	Var. 1	: 65.5	226.0	40.0	56.0	37.5	57.5	47.5	22.0	20.5			
	Var. 2	: 31.70	148.94	133.90	124.38	102.10	171.70	28.00	51.42	37.54			
	F	: 0.48	0.66	3.35	2.22	2.72	2.99	0.59	2.34	1.83		8.02	
	S.D. 2	: 9.6	12.2	11.6	11.1	10.1	13.1	5.3	7.1	6.1			
<u>Corynebacterium</u> <u>fimi</u>	(Av.)	: 967.0	(932.5)	1,016.0	1,001.5	1,005.0	982.0	1,013.5	981.0	1,035.0	2, 4		
	Var. 1	: 1.0	111.5	7.5	2.5	3.0	2.5	11.5	10.5	36.5			
	Var. 2	: 392.0	242.0	2,592.0	2,178.0	2,312.0	288.0	2,178.0	200.0	200.0			
	F	: 392.00	2.17	345.60	871.20	770.67	115.20	189.39	19.05	5.48		13.7	
	S.D. 2	: 19.8	15.5	50.9	46.6	48.0	17.0	46.6	14.1	14.1			
<u>Proteus</u> <u>vulgaris</u>	(Av.)	: (931.5)	(869.0)	978.0	965.0	971.5	950.0	983.5	941.0	992.5	2, 9		
	Var. 1	: 22.5	695.0	10.0	8.5	12.0	32.0	3.0	6.0	4.5			
	Var. 2	: 882.0	4,232.0	72.0	392.0	162.0	1,152.0	50.0	288.0	18.0			
	F	: 39.20	6.09	7.20	46.12	13.50	36.00	16.67	48.00	4.00		13.7	
	S.D. 2	: 29.6	65.0	8.5	19.8	12.7	33.8	7.1	17.0	4.2			

Species

Pseudomonas (Av.)
aeruginosa Var.
Var.
F
S.D.

Pseudomonas (Av.)
reptilivora Var.
Var.
F
S.D.

Pseudomonas (Av.)
chlororaphis Var.
Var.
F
S.D.

Pseudomonas (Av.)
eisenbergii Var.
Var.
F
S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 10 (Page 10)

Species		Wavelength in microns										Group	: F ratio : that : would be : exceeded : 1% of : time by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Aeromonas</u> <u>hydrophila</u>	(Av.)	(933.5)	(902.0)	983.0	972.5	981.0	961.5	988.5	958.0	989.0	2, 6		
	Var. 1	13.0	140.5	4.0	9.0	6.5	4.5	6.0	7.0	6.0			
	Var. 2	2.0	200.0	32.0	50.0	32.0	50.0	50.0	32.0	72.0			
	F	0.15	1.42	8.00	5.56	4.92	11.11	8.33	4.57	12.00		13.7	
	S.D. 2	1.4	14.1	5.6	7.1	5.6	7.1	7.1	5.6	8.5			
<u>Agrobacterium</u> <u>radiobacter</u>	(Av.)	954.5	(925.5)	995.5	981.5	986.0	971.5	997.0	973.5	1,004.5	2, 4		
	Var. 1	37.0	34.0	11.5	32.5	17.0	46.5	16.5	17.0	12.5			
	Var. 2	162.0	1,058.0	162.0	162.0	72.0	98.0	72.0	882.0	98.0			
	F	4.38	31.12	14.09	4.98	4.24	2.11	4.36	51.88	7.84		13.7	
	S.D. 2	12.7	32.5	12.7	12.7	8.5	9.9	8.5	29.6	9.9			
<u>Agrobacterium</u> <u>tumefaciens</u>	(Av.)	955.5	(927.0)	999.5	984.0	989.0	976.0	999.0	978.5	1,005.0	2, 4		
	Var. 1	69.5	27.0	29.5	21.5	21.5	37.5	19.0	4.5	15.5			
	Var. 2	578.0	1,352.0	98.0	128.0	72.0	200.0	72.0	242.0	8.0			
	F	8.32	50.07	3.32	5.95	3.35	5.33	3.79	53.78	0.52		13.7	
	S.D. 2	24.0	36.7	9.9	11.3	8.5	14.1	8.5	15.5	2.8			
<u>Aerobacter</u> <u>aerogenes</u>	(Av.)	964.5	(937.5)	1,006.0	984.5	988.0	978.0	1,002.5	980.5	1,018.0	2, 7		
	Var. 1	138.5	383.5	51.5	14.5	19.0	28.0	45.5	16.5	4.0			
	Var. 2	722.0	2,178.0	800.0	18.0	8.0	32.0	242.0	98.0	200.0			
	F	5.21	5.68	15.53	1.24	0.42	1.14	5.32	5.94	50.00		13.7	
	S.D. 2	26.8	46.6	28.2	4.2	2.8	5.6	15.5	9.9	14.1			
<u>Aerobacter</u> <u>cloacae</u>	(Av.)	964.0	(923.0)	999.0	987.5	990.5	980.5	996.5	977.0	1,010.0	2, 4		
	Var. 1	1.0	34.0	19.0	16.5	7.5	9.0	24.5	5.0	103.0			
	Var. 2	3,200.0	7,200.0	648.0	578.0	578.0	722.0	450.0	1,352.0	512.0			
	F	3,200.00	211.76	34.11	35.03	77.07	80.22	18.37	270.40	4.97		13.7	
	S.D. 2	56.5	84.8	25.4	24.0	24.0	26.8	21.2	36.7	22.6			

Species

Pseudomonas (Av.)
aeruginosa Var.
Var.
F
S.D.

Pseudomonas (Av.)
reptilivora Var.
Var.
F
S.D.

Pseudomonas (Av.)
chlororaphis Var.
Var.
F
S.D.

Pseudomonas (Av.)
eisenbergii Var.
Var.
F
S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 10 (Page 11)

Species		Wavelength in microns										Group	: F ratio : that : would be : exceeded : 1% of : time by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Achromobacter</u> <u>lacticum</u>	(Av.)	: 956.0	(915.0)	1,000.5	980.0	985.5	975.0	999.5	967.5	1,006.0	2, 5		
	Var. 1	: 17.5	135.5	17.0	32.5	87.0	15.0	10.5	3.5	28.5			
	Var. 2	: 4,608.0	2,888.0	2,738.0	1,568.0	1,682.0	1,800.0	2,178.0	1,922.0	3,200.0			
	F	: 263.31	21.31	161.06	48.25	19.33	120.00	207.43	549.14	112.28		13.7	
	S.D. 2	: 67.8	53.7	52.3	39.6	40.9	42.4	46.6	43.8	56.5			
<u>Bacterium</u> <u>stewartii</u>	(Av.)	: (935.5)	(895.5)	989.0	980.0	982.5	961.5	991.5	973.0	1,002.5	2, 5		
	Var. 1	: 4.0	23.5	20.0	28.5	6.5	45.5	8.0	106.0	30.0			
	Var. 2	: 50.0	98.0	8.0	32.0	18.0	162.0	2.0	200.0	2.0			
	F	: 12.5	4.17	0.40	1.12	2.77	3.56	0.25	1.89	0.07		13.7	
	S.D. 2	: 7.1	9.9	2.8	5.6	4.2	12.7	1.4	14.1	1.4			
<u>Erwinia</u> <u>amylovora</u>	(Av.)	: (945.0)	(883.5)	984.5	973.5	979.0	967.0	987.0	955.5	991.0	2, 9		
	Var. 1	: 17.5	78.0	18.0	46.0	10.0	17.5	10.0	53.0	19.5			
	Var. 2	: 2,048.0	3,698.0	162.0	98.0	72.0	512.0	32.0	98.0	72.0			
	F	: 117.03	47.41	9.00	2.13	7.20	29.26	3.20	1.85	3.69		13.7	
	S.D. 2	: 45.2	60.8	12.7	9.9	8.5	22.6	5.6	9.9	8.5			
<u>Escherichia</u> <u>coli</u>	(Av.)	: (957.0)	(908.5)	999.0	985.0	990.0	972.5	1,000.5	975.0	1,010.5	2, 10		
	Var. 1	: 409.5	1,011.0	149.5	104.5	124.5	307.5	103.5	113.5	55.0			
	Var. 2	: 392.0	50.0	288.0	200.0	200.0	882.0	162.0	288.0	50.0			
	F	: 0.96	0.05	1.93	1.91	1.61	2.87	1.57	2.54	0.91		13.7	
	S.D. 2	: 19.8	7.1	17.0	14.1	14.1	29.7	12.7	17.0	7.1			
<u>Serratia</u> <u>marcescens</u>	(Av.)	: (931.5)	(878.0)	976.0	962.0	970.5	953.5	981.5	944.5	990.0	2, 18		
	Var. 1	: 89.5	132.0	113.0	103.5	85.5	88.0	36.5	46.0	24.5			
	Var. 2	: 338.0	8.0	200.0	128.0	98.0	102.0	50.0	242.0	72.0			
	F	: 3.78	0.06	1.77	1.24	1.15	1.84	1.37	5.26	2.94		13.7	
	S.D. 2	: 18.4	2.8	14.1	11.3	9.9	12.7	7.1	15.6	8.5			

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 11 (Page 1)

AVERAGES OF TRANSMISSION VALUES FOR EACH GENUS TOGETHER WITH THEIR VARIANCES, "F" RATIOS, AND STANDARD DEVIATIONS FOR EACH GENUS

Genus		Wavelength in microns										Group	: F ratio : ex- : ceeded : 1% of : time : by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Pseudomonas</u>	(Av.) ^a	(946.72)	(901.32)	985.06	972.03	980.37	966.92	989.63	955.35	989.59	26, 119,		
	Var. 1 ^b	130.02	264.58	74.07	57.13	49.53	52.20	53.74	99.74	47.76	516		
	Var. 2 ^c	205.30	1,015.29	217.67	162.06	141.97	162.06	177.50	251.98	188.30			
	F	1.58	3.84	2.94	2.84	2.87	3.10	3.30	2.53	3.94		2.12	
	S.D. 2 ^d	14.3	31.8	14.7	12.7	11.9	12.7	13.3	15.9	13.7			
<u>Bacillus</u>	(Av.)	(934.97)	(901.97)	988.25	977.03	981.33	(961.05)	990.53	(968.01)	998.04	16, 76,		
	Var. 1	175.88	260.34	59.22	51.30	39.59	104.92	37.68	58.77	24.57	290		
	Var. 2	1,215.56	4,028.31	577.04	523.01	335.18	695.96	336.56	555.76	315.89			
	F	6.91	15.47	9.74	10.20	8.47	6.63	8.93	9.46	12.86		2.35	
	S.D. 2	34.8	63.4	24.0	22.8	18.3	26.3	18.3	23.6	17.8			
<u>Acetobacter</u>	(Av.)	(978.26)	(938.07)	1,012.96	991.37	995.52	985.63	1,006.48	981.26	1,016.48	18, 27,		
	Var. 1	747.83	1,384.39	422.17	303.33	221.17	304.22	193.83	366.39	188.78	66		
	Var. 2	364.75	1,245.79	450.79	226.72	197.19	168.14	230.95	198.45	233.55			
	F	0.49	0.90	1.07	0.75	0.89	0.55	1.19	0.54	1.24		4.96	
	S.D. 2	19.1	35.2	21.2	15.0	14.0	13.0	15.2	14.1	15.2			

^a Average of all species averages for the genus weighted according to number of strains in species.

^b Average of variance of strain averages in all species of the genus weighted by number of strains.

^c Variance of species averages in genus.

^d Standard deviation of species averages in genus.

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain at

b Average of strain va

c Variance of strain a

d Standard deviation c

Table 11 (Page 2)

Genus		Wavelength in microns										Group	: F ratio : ex- : ceeded : 1% of : time : by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Achromobacter</u>	(Av.)	957.33	(908.33)	996.67	978.33	983.67	974.67	995.67	968.33	1,001.33	2, 3,		
	Var. 1	1,152.0	722.0	684.5	392.0	420.5	450.0	544.5	480.5	800.0	7		
	Var. 2	10.7	266.7	88.2	16.7	20.2	0.7	88.2	4.2	130.7			
	F	0.01	0.37	0.13	0.04	0.05	0.002	0.16	0.01	0.16		4,052.00	
	S.D. 2	3.3	16.3	9.4	4.1	4.5	0.8	9.4	2.0	11.4			
<u>Aerobacter</u>	(Av.)	964.25	(930.25)	1,002.50	986.00	989.25	979.25	999.50	978.75	1,014.00	2, 4,		
	Var. 1	490.25	1,172.25	181.00	74.50	73.25	94.25	86.50	181.25	89.00	11		
	Var. 2	0.25	10.25	49.00	9.00	6.25	6.25	36.00	12.25	64.00			
	F	0.0005	0.01	0.27	0.12	0.09	0.07	0.42	0.07	0.72		98.5	
	S.D. 2	0.5	3.2	7.0	3.0	2.5	2.5	6.0	3.5	8.0			
<u>Aeromonas</u>	(Av.)	(924.0)	(880.4)	973.6	960.0	970.2	946.4	981.2	944.6	986.8	4, 5,		
	Var. 1	0.5	50.0	8.0	12.5	8.0	12.5	12.5	8.0	18.0	11		
	Var. 2	113.8	862.4	142.4	204.5	190.3	374.9	88.8	254.4	26.9			
	F	227.6	17.25	17.8	16.36	23.78	29.99	7.10	31.8	1.50			
	S.D. 2	10.6	29.4	11.9	14.3	13.8	19.4	9.4	15.9	5.2			
<u>Agrobacterium</u>	(Av.)	952.00	(917.20)	996.80	983.20	987.40	974.20	997.20	974.40	1,005.80	3, 5,		
	Var. 1	92.50	301.25	32.50	36.25	18.00	37.25	18.00	140.50	13.25	9		
	Var. 2	90.50	820.10	12.90	5.15	4.60	12.15	8.40	38.10	11.15			
	F	0.98	2.72	0.40	0.14	2.56	0.33	0.47	0.27	0.84		99.0	
	S.D. 2	9.5	28.6	3.6	2.3	2.1	3.5	2.9	6.2	3.3			
<u>Alcaligenes</u>	(Av.)	(944.00)	(910.50)	984.00	970.50	977.00	966.00	986.00	961.00	993.50	2, 2,		
	★ Var. 1	309.5	162.5	151.0	60.5	73.0	110.00	59.5	84.0	60.0	6		
	★ Var. 2	1,568.0	9,522.0	1,152.0	1,046.0	512.0	800.0	800.0	4,232.0	1,458.0		★ 13.7	
	★ F	5.07	58.60	7.63	17.29	7.01	7.27	13.45	50.38	24.30			
	S.D. 2	19.8	48.7	17.0	16.1	11.3	14.1	14.1	32.5	19.1			

★ Data obtained from genera having only one strain per species were considered on the basis of averages of the infrared curves for each strain.

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain av

b Average of strain va

c Variance of strain a

d Standard deviation c

Table 11 (Page 3)

Genus		Wavelength in microns										Group	: F ratio : ex- : ceeded : 1% of : time : by : chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Cellulomonas</u>	(Av.)	964.00	(944.00)	1,017.00	994.50	996.50	980.00	1,016.00	989.00	1,029.00	2, 2,		
	★ Var. 1	85.0	51.5	0.5	4.5	6.5	5.0	1.0	16.5	23.0	4		
	★ Var. 2	2,048.0	6,272.0	8.0	1,250.0	882.0	288.0	0.0	1,800.00	200.0			
	★ F	24.09	121.79	16.00	277.78	135.69	57.60	0	109.09	8.70			★ 13.7
	S.D. 2	22.6	39.6	1.4	17.7	14.8	8.5	0.0	21.2	7.1			
<u>Corynebacterium</u>	(Av.)	(965.17)	(927.50)	1,015.50	998.00	1,003.83	983.33	1,011.00	984.50	1,035.67	5, 6,		
	Var. 1	98.0	60.5	648.0	544.5	578.0	72.0	544.5	50.0	50.0	19		
	Var. 2	597.70	973.25	305.88	353.38	223.20	487.33	162.88	339.38	62.33			
	F	6.00	16.09	0.47	0.65	0.39	6.77	0.30	6.79	1.25			5,625.0
	S.D. 2	24.4	31.1	17.5	18.8	14.9	22.0	12.7	18.4	7.9			
<u>Erwinia</u>	(Av.)	(940.00)	(895.67)	981.67	969.67	976.00	960.00	985.00	955.67	992.00	2, 3,		
	Var. 1	512.0	924.5	40.5	24.5	18.0	128.0	8.0	24.5	18.0	12		
	Var. 2	150.0	888.2	48.2	88.2	54.0	294.0	24.0	0.2	6.0			
	F	0.29	0.96	1.19	3.60	3.00	2.30	3.00	0.01	0.33			4,052.0
	S.D. 2	12.2	29.8	6.9	9.4	7.3	17.1	993.00	4.9	2.4			
<u>Flavobacterium</u>	(Av.)	(948.67)	(907.33)	993.67	974.33	981.67	965.33	993.00	967.33	1,008.67	3, 3,		
	★ Var. 1	37.00	98.00	95.00	40.67	44.67	27.00	96.67	26.00	92.67	9		
	★ Var. 2	2,023.38	2,261.62	2,981.58	1,940.30	1,954.06	1,603.94	2,224.00	1,468.20	4,692.80			
	★ F	54.69	23.08	31.39	47.71	43.74	59.41	23.00	56.47	50.64			★ 8.02
	S.D. 2	22.4	23.8	27.3	22.0	22.1	20.1	23.6	19.2	34.2			
<u>Micrococcus</u>	(Av.)	(951.00)	(926.29)	997.86	984.00	987.57	969.00	997.00	968.57	1,008.71	5, 7,		
	Var. 1	7.92	37.24	33.48	31.10	25.52	42.92	7.00	12.86	9.38	34		
	Var. 2	1,219.32	2,138.18	501.55	398.82	325.25	671.32	224.50	1,069.25	431.68			
	F	153.86	57.42	14.98	12.82	12.74	15.64	32.07	83.18	46.00			99.2
	S.D. 2	34.9	46.2	22.4	19.9	18.0	25.9	15.0	32.7	20.7			

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain at

b Average of strain va

c Variance of strain a

d Standard deviation c

Table 11 (Page 4)

Genus		Wavelength in microns										Group	F ratio ex- ceeded 1% of time by chance
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>Nocardia</u>	(Av.)	(944.75)	(916.50)	998.25	978.75	988.75	966.75	1,001.25	972.00	1,024.25	4, 4,		
	★ Var. 1	102.00	322.25	37.25	14.50	7.75	17.00	7.00	11.50	24.00	18		
	★ Var. 2	1,571.68	1,142.67	1,713.00	761.00	1,027.67	1,211.67	1,107.67	1,474.67	1,803.67			
	★ F	15.41	3.55	45.99	52.48	132.60	71.27	158.24	128.23	75.15			★ 5.95
	S.D. 2	19.8	16.9	20.7	13.8	16.0	17.4	16.6	19.1	21.2			
<u>Proteus</u>	(Av.)	(926.17)	(872.67)	975.33	962.50	968.83	948.00	981.50	941.50	993.00	5, 6,		
	Var. 1	220.5	1,058.0	18.0	98.0	40.5	288.0	12.5	72.0	4.5	31		
	Var. 2	50.08	57.32	32.32	44.88	45.58	60.50	21.25	63.38	39.88			
	F	0.23	0.05	1.80	0.46	1.13	0.21	1.70	0.88	8.86			
	S.D. 2	7.1	7.6	5.7	6.7	6.8	7.8	4.6	8.0	6.3			
<u>Sarcina</u>	(Av.)	(950.33)	(937.33)	997.00	(977.67)	983.67	(968.33)	998.00	987.33	1,012.00	3, 3,		
	★ Var. 1	45.00	115.00	5.00	140.00	10.33	18.33	4.00	5.00	7.00	19		
	★ Var. 2	1,779.4	3,147.0	3,472.0	3,602.4	4,581.8	1,500.0	2,196.0	4,649.0	2,064.0			★ 8.02
	★ F	39.54	27.37	694.40	25.73	443.54	81.83	549.00	929.80	294.86			
	S.D.	21.1	28.0	29.4	30.0	33.8	19.3	23.4	34.0	22.7			
<u>Streptomyces</u>	(Av.)	(945.67)	(912.33)	997.00	981.00	987.67	973.33	1,002.00	984.33	1,017.33	3, 3,		
	★ Var. 1	104.33	85.00	68.00	24.33	33.33	34.00	44.67	13.67	15.00	9		
	★ Var. 2	643.5	7,742.0	496.0	532.0	206.0	788.2	388.0	853.0	826.0			★ 8.02
	★ F	6.16	91.08	7.29	21.87	6.18	23.18	8.69	62.40	55.07			
	S.D.	12.7	44.0	11.1	11.5	7.2	14.0	9.8	14.6	14.3			
<u>Vibrio</u>	(Av.)	(928.40)	(887.00)	977.60	963.00	972.80	950.00	982.60	946.40	991.40	5, 5,		
	★ Var. 1	34.8	277.6	11.0	8.8	8.4	25.4	7.6	16.6	16.0	27		
	★ Var. 2	267.2	1,146.0	69.2	142.0	42.8	294.0	29.2	251.2	185.2			★ 4.89
	★ F	7.68	4.13	6.29	16.14	5.10	11.57	3.84	15.13	11.58			
	S.D.	8.2	16.9	4.2	6.0	3.3	8.6	2.7	7.9	6.8			

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 11 (Page 5)

Genus		Wavelength in microns										Group	: F ratio	
		6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			: ex-	: ceeded
													: 1% of	: time
													: by	: chance
<u>Xanthomonas</u>	(Av.)	(960.00)	(940.00)	1,000.45	983.09	986.45	974.73	999.64	973.63	1,012.73	11,11,			
	* Var. 1	83.0	257.56	62.71	25.61	17.64	29.64	44.23	53.27	20.27	66			
	* Var. 2	1,406.4	4,136.0	499.52	249.84	130.16	326.96	244.36	1,145.28	452.36				
	* F	16.94	16.06	7.97	9.76	7.38	11.03	5.52	21.50	22.32			* 2.98	
	S.D. 2	18.7	32.1	11.1	7.9	5.7	9.0	7.8	16.9	10.6				

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain at

b Average of strain ve

c Variance of strain a

d Standard deviation c

Table 12

AVERAGES OF TRANSMISSION VALUES FOR GROUPS OF GENERA TOGETHER WITH THEIR VARIANCES,
"F" RATIOS, AND STANDARD DEVIATION OF THE GROUP

	Selected wavalengths in microns										Group	F ratio exceeded 1% of time by chance
	6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
<u>All genera: Item 1</u>												
(Av.) ^a	(949.36)	(912.65)	993.01	977.49	983.65	(968.03)	994.36	(966.41)	1,003.61	31, 133,		
Var. 1 ^b	443.30	1,422.86	314.23	242.63	194.22	274.98	190.23	338.59	225.11	310,		
Var. 2 ^c	1,149.92	1,914.98	790.48	531.08	1,380.11	525.13	395.12	865.13	820.53	1232		
F	2.59	1.34	2.52	2.19	7.10	1.91	2.08	2.56	3.64			2.03
S.D. 2 ^d	33.9	43.7	28.1	23.0	37.1	22.9	19.9	29.4	28.6			
<u>Group of Psaudomonas and Bacillus: Itam 2</u>												
(Av.)	(942.42)	(901.56)	986.23	973.86	980.72	(964.77)	989.96	(959.98)	992.68	2, 41, 194,		
Var. 1	567.97	2,096.89	346.67	291.63	211.33	610.13	234.60	361.03	234.10	802		
Var. 2	1,313.2	4.0	96.7	237.7	8.8	327.7	7.7	1,524.6	679.2			
F	2.31	0.002	0.28	0.81	0.04	0.54	0.03	4.22	2.90			4.08
S.D. 2	36.2	2.0	9.8	15.4	3.0	18.1	2.8	39.1	26.1			
<u>Group of Acetobacter, Bacillus, and Pseudomonas: Itam 3</u>												
(Av.)	(953.36)	(912.70)	994.38	979.20	985.24	(971.14)	995.00	(966.47)	999.94	3, 59, 221,		
Var. 1	480.52	1,745.03	359.05	258.10	196.51	282.26	221.62	295.83	222.03	868		
Var. 2	8,689.5	8,349.8	4,168.0	2,036.5	1,374.0	2,884.6	1,710.8	3,594.0	3,881.8			
F	18.08	4.78	11.61	7.89	6.99	10.22	7.72	12.15	17.48			4.13
S.D. 2	94.0	91.2	64.6	45.1	37.0	54.5	41.3	60.0	61.7			

^a Average of genus averages weightad by number of specias in ganus.

^b Average of variances of spacias avarages in all ganera weightad by numbar of specias in genus.

^c Variance of ganus averagas.

^d Standard daviation of ganus avaragas.

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

AVERAGES OF TRANSMISSION VALUES OF VARIOUS GROUPS TOGETHER WITH VARIANCES,
"F" RATIOS, AND STANDARD DEVIATIONS

Item	Bacillus megaterium		Wavelength in microns										Group	F ratio exceeded 1% of time by chance
			6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1	8.5			
1	Group B, (NRS308, B350, NRS627, NRS872, NRS892, NRS895, NRS923, NRS931)	(Av.) Var. 1 Var. 2 F S.D. 2	(941.0) 124.12 10.29 0.08 3.7	(930.38) 117.38 183.70 1.56 13.6	995.0 78.88 218.28 2.77 14.7	981.62 35.38 97.39 2.75 9.9	984.0 33.25 69.71 2.10 8.3	963.12 59.25 51.41 0.87 7.2	992.88 42.25 62.56 1.48 7.9	977.0 14.0 272.0 19.43 16.5	1,005.25 27.0 107.15 3.97 10.3	8, 32	3.50	
2	Group C, (NRS607, NRS608, NRS610, NRS623, NRS822, NRS824, NRS828, NRS829, NRS835, NRS837, NRS907)	(Av.) Var. 1 Var. 2 F S.D. 2	(951.08) 120.09 378.36 3.15 19.4	(944.45) 79.0 272.48 3.45 16.5	1,001.7 13.91 148.48 10.67 12.2	989.27 5.0 54.23 10.85 7.4	991.91 5.45 52.24 9.58 7.2	978.64 7.27 27.3 3.76 5.2	1,000.0 8.27 35.2 4.26 5.9	981.64 4.36 139.2 31.93 11.8	1,009.82 7.36 23.71 3.22 4.9	11, 44	2.98	
3	Group C4 (NRS608, NRS610, NRS828, NRS835, NRS837, NRS907)	(Av.) Var. 1 Var. 2 F S.D. 2	(948.17) 144.33 600.72 4.16 24.5	(943.5) 44.5 268.4 6.03 16.3	1,004.83 17.17 4.02 0.23 2.0	990.5 5.83 10.8 1.85 3.3	993.33 6.5 2.77 0.43 1.7	989.17 9.5 13.17 1.39 3.6	1,001.67 9.17 9.01 0.98 3.0	982.5 3.0 126.0 42.0 11.2	1,010.33 5.33 10.99 2.06 3.3	6, 24	4.25	
4	Pseudomonas less P. aeruginosa	(Av.) Var. 1 Var. 2 F S.D. 2	(951.97) 205.58 75.14 0.37 8.7	(902.15) 352.18 1,054.11 2.99 32.4	987.60 155.37 194.18 1.25 13.9	974.43 106.31 139.77 1.31 11.8	982.90 101.69 115.61 1.14 10.7	969.53 96.27 134.50 1.40 11.6	992.62 119.64 139.92 1.17 11.8	957.67 173.30 235.48 1.36 15.3	991.88 103.54 169.59 1.64 13.0	25, 60, 281	2.47	

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 13 (Page 2)

Item	Bacillus megaterium		Wavelength in microns								Group	F ratio exceeded 1% of time by chance	
			6.3	6.5	6.8	6.9	7.0	7.2	7.5	8.1			8.5
5	Bacillus, Group A	(Av.)	(933.0)	(904.67)	983.17	973.83	978.08	955.42	986.67	965.17	993.92	4, 12,	
	(circulans, macerans	Var. 1	395.01	546.65	123.09	103.39	85.62	209.08	87.11	100.56	33.19	46	
	pulvifaciens pumilus)	Var. 2	310.83	145.93	60.73	41.83	40.47	155.80	45.10	59.73	3.73		
		F	0.79	0.27	0.49	0.40	0.47	0.75	0.52	0.59	0.11		7.59
		S.D. 2	17.6	12.1	7.8	6.5	6.4	12.5	6.7	7.7	1.9		
6	Bacillus, Group B, (alvei,	(Av.)	(930.14)	(908.92)	989.04	978.21	982.07	961.14	991.50	967.96	998.14	6, 28,	
	firmus, lentus, licheni-	Var. 1	196.76	311.58	47.80	41.08	32.60	73.64	36.16	53.65	29.02	107	
	formis, pantothenicus,	Var. 2	1,144.16	2,294.56	122.48	59.62	58.12	335.40	142.44	62.56	2.18		
	subtilis	F	5.82	7.36	2.56	1.45	1.78	4.55	3.94	1.17	0.08		3.99
		S.D. 2	33.8	46.9	11.1	7.7	7.6	18.3	11.9	7.9	1.5		
7	Pseudomonas reptilivora,	(Av.)	941.25	(883.25)	971.5	961.25	972.0	960.75	979.75	938.75	977.75	4, 16	
	Group A	Var. 1	27.0	52.5	12.75	23.25	6.75	17.75	8.75	55.08	3.82		
		Var. 2	11.68	222.35	1.33	3.68	2.67	3.68	3.68	30.35	9.01		
		F	0.43	4.24	0.10	0.16	0.40	0.21	0.42	0.55	2.36		5.95
		S.D. 2	3.4	14.9	1.15	1.92	1.63	1.92	1.92	5.5	3.0		
8	Pseudomonas reptilivora,	(Av.)	925.5	(872.5)	979.5	965.0	975.5	956.5	986.0	947.5	986.0	2, 8	
	Group B	Var. 1	46.0	48.0	30.0	28.5	22.0	30.0	18.5	55.0	6.5		
		Var. 2	18.0	50.0	2.0	8.0	18.0	18.0	0.0	18.0	8.0		
		F	0.39	1.04	0.07	0.28	0.82	0.60	0.0	0.32	1.23		13.74
		S.D. 2	4.2	7.1	1.4	2.8	4.2	4.2	0.0	4.2	2.8		

Species

Pseudomonas (Av.)
aeruginosa Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
reptilivora Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
chlororaphis Var.
 Var.
 F
 S.D.

Pseudomonas (Av.)
eisenbergii Var.
 Var.
 F
 S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c

Table 14

VARIOUS "t" TESTS

Item	Groups	Wave-lengths in microns	Differ- ence of averages	s_m^2	s_n^2	s^2	s	No. of entries: m : n	$\sqrt{\frac{mn}{m+n}}$	t	Proba- bility of being exceeded by chance	Unit of popu- lation
1	B vs. C	7.2	15.52	51.41	27.3	37.5	6.12	8 11	2.15	5.45	0.005	Strain
2	B ₁ vs. B ₂	8.1	6	14	1	7.5	2.74	4 4	1.41	3.09	.01	Curves
3	B ₂ vs. NRS308	8.1	7	1	4	2.5	1.57	4 4	1.41	6.28	.005	Curves
4	NRS308 vs. NRS895	8.1	2	4	7	5.5	2.34	4 4	1.41	1.20	.15	Curves
5	B350 vs. NRS872	8.1	1	1	2	1.5	1.22	4 4	1.41	1.15	.15	Curves
6	B3 vs. B4	8.1	5.5	6	2	4	2.0	8 8	2.0	5.5	.005	Curves
7	B2 vs. B3	8.1	8	1	6	4.5	2.12	4 8	1.62	6.1	.005	Curves
8	NRS627 vs. NRS923	8.1	1	41	42	41.5	6.44	4 4	1.41	0.22	NS	Curves
9	B4 vs. B5	8.1	4	2	36	19	4.36	8 8	2.0	1.83	.05	Curves
10	NRS607 vs. NRS824	6.8	2	15	13	14	3.74	4 4	1.41	0.75	.25	Curves
11	C1 vs. C2	6.8	4	8	13	11.7	3.42	4 8	1.62	1.89	.05	Curves
12	C2 vs. C3	6.8	6	13	5	10.8	3.28	8 4	1.62	2.94	.025	Curves
13	C3 vs. C4	6.8	3.83	0	4.02	4.02	2.0	1 6	0.92	1.76	.10	Strains
14	C4 vs. C5	6.8	3.17	4.02	0	4.02	2.0	6 1	.92	1.46	.10	Strains
15	C4a vs. C4b	8.1	4	3.11	2	2.85	1.69	12 4	1.73	4.1	.005	Curves
16	C4b vs. C4c	8.1	4	2	7	4.5	2.12	4 4	1.41	2.06	.05	Curves
17	C4c vs. C4d	8.1	6	7	2	4.5	2.12	4 4	1.41	3.99	.005	Curves
18	<u>Pseudomonas</u> vs. <u>Bacillus</u>	8.1	12.66	251.98	555.76	361.03	19.0	26 15	3.08	2.05	.05	Species
19	<u>Pseudomonas</u> vs. <u>Bacillus</u>	8.1	11.8	158	183	174	13.2	288 538	13.7	12.25	.001	Curves
20	<u>Bacillus</u> "A" vs. "B"	8.5	3.72	3.73	2.18	2.76	1.66	6 4	1.49	3.34	.01	Species

Species

<u>Pseudomonas</u>	(Av.)
<u>aeruginosa</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>reptilivora</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>chlororaphis</u>	Var.
	Var.
	F
	S.D.

<u>Pseudomonas</u>	(Av.)
<u>eisenbergii</u>	Var.
	Var.
	F
	S.D.

a Average of strain a

b Average of strain v

c Variance of strain a

d Standard deviation c



